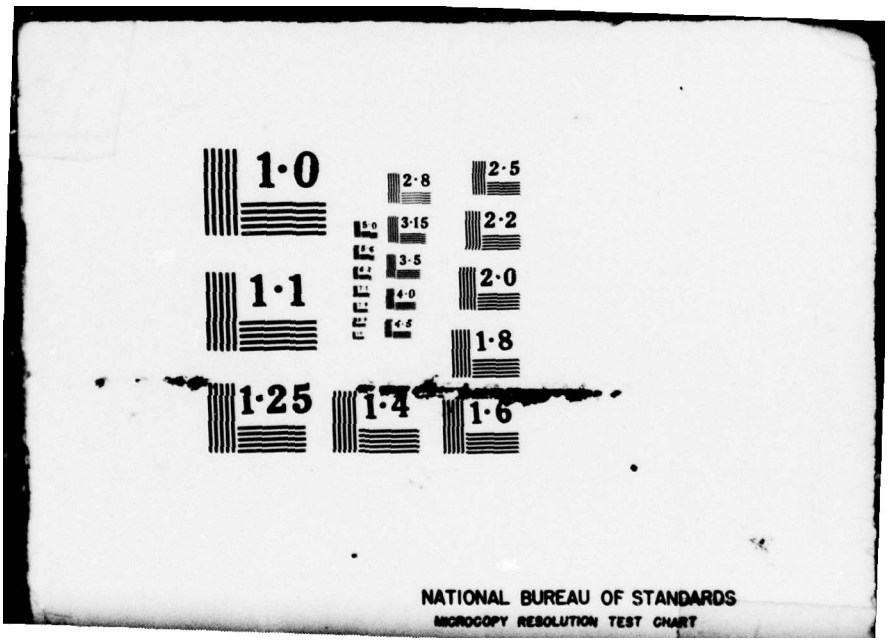
AD-A071 500 INSTITUTE FOR DEFENSE ANALYSES ARLINGTON VA PROGRAM --ETC F/G 5/1
COST-ALLOCATION FOR AUTODIN: AN ECONOMIC ANALYSIS, VOLUME 2: TE--ETC(U)
SEP 77 W F BEAZER, L S DAVIDSON, J N FRY

UNCLASSIFIED IDA-S-487-VOL-2 IDA/HQ-78-20217 NL

1 OF 1
AD
A071500

END
DATE
FILMED
8-79
DDC


1·0
1·1
1·25
2·8
3·15
3·5
4·0
1·4
2·5
2·2
2·0
1·8
1·6
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

IDA STUDY S-487

COST-ALLOCATION FOR AUTODIN: AN ECONOMIC ANALYSIS

VOLUME II: Technical Appendices

William F. Beazer
Lance S. Davidson
John N. Fry
Janet Kiernan
William J. Raduchel

September 1977

Prepared for
Defense Communications Agency

INSTITUTE FOR DEFENSE ANALYSES
PROGRAM ANALYSIS DIVISION

IDA Log No. HQ 78-2021

The work reported in this document was conducted under Task 652-2 for the Defense Communications Agency. The publication of this IDA Paper does not indicate endorsement by the Defense Communications Agency, nor should the contents be construed as reflecting the official opinion of that agency.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1 REPORT NUMBER	2 GOVT ACCESSION NO.	3 RECIPIENT'S CATALOG NUMBER
4 TITLE (and Subtitle) COST-ALLOCATION FOR AUTODIN: AN ECONOMIC ANALYSIS - Vol II: Technical Appendixes		5 TYPE OF REPORT & PERIOD COVERED FINAL
		6 PERFORMING ORG REPORT NUMBER S-487
7 AUTHOR(s) Beazer, William F., Davidson, Lance S., Fry, John N., Kiernan, Janet, Raduchel, William J.		8 CONTRACT OR GRANT NUMBER(s)
9 PERFORMING ORGANIZATION NAME AND ADDRESS INSTITUTE FOR DERENSE ANALYSES 400 Army-Navy Drive Arlington, Virginia 22202		10 PROGRAM ELEMENT PROJECT TASK AREA & WORK UNIT NUMBERS DCA Task 652-1
11 CONTROLLING OFFICE NAME AND ADDRESS Defense Communications Agency ATTN: Code 670 Arlington, VA		12 REPORT DATE September 1977
		13 NUMBER OF PAGES 81
14 MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15 SECURITY CLASS (of this report) UNCLASSIFIED
		15a DECLASSIFICATION DOWNGRADING SCHEDULE N/A

16 DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17 DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18 SUPPLEMENTARY NOTES

19 KEY WORDS (Continue on reverse side if necessary and identify by block number)

Digital Communications, Store and Forward Networks, Cost-Allocation, Economics and Public Utilities, Communications Rate Structures, Computer Simulation, Industrial Fund

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

The theoretical basis for a usage-sensitive rate structure for DCA's ATUODIN I network is developed and applied to a simulation using sample data to develop sample rates and to assess the possible budgetary effects of implementing such a structure.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

IDA STUDY S-487

COST-ALLOCATION FOR AUTODIN: AN ECONOMIC ANALYSIS

VOLUME II: AUTODIN Technical Appendices

William F. Beazer
Lance S. Davidson
John N. Fry
Janet Kiernan
William J. Raduchel

September 1977

IDA
INSTITUTE FOR DEFENSE ANALYSES
PROGRAM ANALYSIS DIVISION
400 Army-Navy Drive, Arlington, Virginia 22202

Task 652-2

CONTENTS

APPENDICES

FIGURES

TABLES

PREFACE

The appendixes in this volume are intended to provide the user with the technical information needed to reproduce the simulation program used in the analysis and to process additional samples of AUTODIN traffic. While the appendixes are complete, the user may benefit from reviewing the logical cost model as it is developed in Chapter II of Volume I.

APPENDIX B

TRAFFIC ANALYSIS

DCA SEVEN DAY SAMPLE

(Program Print-Out Facsimiles)

AUTODIN-I TRAFFIC ANALYSIS (7 DAY SAMPLE)

SYSTEM ACCESS ANALYSIS

AGENCY	SLOW				MEDIUM				HIGH				ALL			
	NUMBER	AGENCY PERCENT	SYSTEM PERCENT	TOTAL PERCENT	NUMBER	AGENCY PERCENT	SYSTEM PERCENT	TOTAL PERCENT	NUMBER	AGENCY PERCENT	SYSTEM PERCENT	TOTAL PERCENT	NUMBER	AGENCY PERCENT	SYSTEM PERCENT	TOTAL PERCENT
D	165	99.40	18.48	12.48	1	.60	.32	.08	0	0.00	0.00	0.00	166	100.00	12.56	12.56
A	244	63.38	27.32	18.46	108	28.05	34.29	8.17	33	8.57	28.95	2.50	385	100.00	29.12	29.12
B	82	48.52	9.18	6.20	53	31.36	16.83	4.01	34	20.12	29.82	2.57	169	100.00	12.78	12.78
C	218	71.71	24.41	16.49	79	25.99	25.08	5.98	7	2.30	6.14	.53	304	100.00	23.00	23.00
E	14	77.78	1.57	1.06	3	16.67	.95	.23	1	5.56	.88	.08	18	100.00	1.36	1.36
F	31	93.94	3.47	2.34	2	6.06	.63	.15	0	0.00	0.00	0.00	33	100.00	2.50	2.50
G	0	0.00	0.00	0.00	10	33.33	3.17	.76	20	66.67	17.54	1.51	30	100.00	2.27	2.27
M	3	100.00	.34	.23	0	0.00	0.00	0.00	0	0.00	0.00	0.00	3	100.00	.23	.23
N	0	0.00	0.00	0.00	1	100.00	.32	.08	0	0.00	0.00	0.00	1	100.00	.08	.08
P	26	72.22	2.91	1.97	4	11.11	1.27	.30	6	16.67	5.26	.45	36	100.00	2.72	2.72
W	4	100.00	.45	.30	0	0.00	0.00	0.00	0	0.00	0.00	0.00	4	100.00	.30	.30
X	9	56.25	1.01	.68	7	43.75	2.22	.53	0	0.00	0.00	0.00	16	100.00	1.21	1.21
6	97	61.78	10.86	7.34	47	29.94	14.92	3.56	13	8.28	11.40	.98	157	100.00	11.88	11.88
*	893	67.55	100.00	67.55	315	23.83	100.00	23.83	114	8.62	100.00	8.62	1322	100.00	100.00	100.00

LINE BLOCKS
TOTALS

AGENCY	*REGULAR TRAFFIC* LOCAL	AREA	INTER-AREA	ALL	*FLASH TRAFFIC* LOCAL	AREA	INTER-AREA	ALL
D	1893044.00	647114.00	979039.00	3720137.00	4054.00	282.00	334.00	4671.00
A	4572717.00	3488357.00	12690554.00	21151628.00	4222.00	4265.00	9676.00	18163.00
R	3734827.00	1030443.00	6120470.00	10485740.00	2910.00	836.00	2102.00	5900.00
C	3758258.00	4220704.00	7277992.00	15256948.00	15292.00	14179.00	53794.00	83265.00
E	251217.00	375614.00	339706.00	966538.00	0.00	0.00	0.00	0.00
F	27764.00	4149.00	21223.00	53131.00	0.00	0.00	0.00	0.00
G	4857741.00	1308674.00	10604471.00	15962890.00	0.00	0.00	0.00	0.00
H	2158.00	834.00	3728.00	6914.00	0.00	0.00	0.00	0.00
N	287.00	0.00	682.00	969.00	0.00	0.00	0.00	0.00
P	266442.00	262201.00	1068668.00	4495551.00	330.00	0.00	214.00	552.00
W	2082.00	504.00	16909.00	19497.00	10.00	0.00	0.00	10.00
X	282636.00	544014.00	4091186.00	1215798.00	102.00	18.00	65.00	185.00
S	9650448.00	3771794.00	3301632.00	97842?4.00	10023.00	8474.00	13916.00	32413.00
*	24621427.00	10246364.00	41452188.00	78319983.00	36955.00	28062.00	50147.00	115162.00

LINE BLOCKS
AS PERCENT OF AGENCY TRAFFIC BY CLASS

AGENCY	*REGULAR TRAFFIC*				*FLASH TRAFFIC*			
	LOCAL	AREA	INTER-AREA	ALL	LOCAL	AREA	INTER-AREA	ALL
D	40.22	23.79	35.99	100.00	86.81	6.04	7.15	100.00
A	26.35	16.49	57.16	100.00	23.25	23.48	53.27	100.00
B	26.48	14.55	58.37	100.00	49.26	14.15	36.59	100.00
C	24.63	27.66	47.70	100.00	28.71	26.62	44.67	100.00
E	25.99	38.86	35.15	100.00	0.00	0.00	0.00	0.00
F	52.26	7.80	39.94	100.00	0.00	0.00	100.00	100.00
G	25.42	8.15	66.43	100.00	0.00	0.00	0.00	0.00
M	33.99	12.09	53.92	100.00	0.00	0.00	0.00	0.00
N	29.62	0.00	70.38	100.00	0.00	0.00	0.00	0.00
P	38.34	37.70	23.96	100.00	59.78	1.45	38.77	100.00
W	10.68	2.60	86.73	100.00	100.00	0.00	0.00	100.00
X	16.67	44.75	38.59	100.00	61.82	10.91	27.27	100.00
6	27.09	38.55	34.36	100.00	30.92	26.14	42.93	100.00
*	26.33	20.74	52.93	100.00	32.09	24.37	43.54	100.00

LINE BLOCKS
AS PERCENT OF SYSTEM TRAFFIC BY CLASS

AGENCY	*REGULAR TRAFFIC*				*FLASH TRAFFIC*			
	LOCAL	AREA	INTER-AREA	ALL	LOCAL	AREA	INTER-AREA	ALL
D	5.31	3.98	2.36	3.47	10.97	1.00	.67	4.06
A	27.02	21.47	29.17	27.01	11.43	15.20	19.30	15.77
B	13.26	10.04	14.77	13.39	7.87	2.98	4.31	5.13
C	18.22	25.98	17.56	19.48	41.38	50.53	47.48	46.28
E	1.22	2.31	.82	1.23	0.00	0.00	0.00	0.00
F	.13	.03	.05	.07	0.00	0.00	.01	.01
G	19.68	8.01	25.58	20.38	0.00	0.00	0.00	0.00
H	.01	.01	.01	.01	0.00	0.00	0.00	0.00
N	.00	0.00	.00	.00	0.00	0.00	0.00	0.00
P	1.29	1.61	.40	.89	.89	.03	.43	.48
W	.01	.00	.04	.02	.05	0.00	0.00	.02
X	.98	3.35	1.13	1.55	.28	.06	.09	.14
6	12.86	23.22	8.11	12.49	27.12	30.20	27.75	28.15
*	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

AUTODIN-I TRAFFIC ANALYSIS (7 DAY SAMPLE) PAGE 5

LINE BLOCKS
AS PERCENT OF TOTAL SYSTEM TRAFFIC

AGENCY	*REGULAR TRAFFIC*				*FLASH TRAFFIC*			
	LOCAL	AREA	INTER-AREA	ALL	LOCAL	AREA	INTER-AREA	ALL
D	1.40	.83	1.25	3.47	3.52	.24	.29	4.06
A	7.12	4.45	15.44	27.01	3.67	3.78	8.46	15.77
B	3.49	2.08	7.81	13.39	2.53	.73	1.88	5.13
C	4.80	5.39	9.29	19.48	13.28	12.31	20.66	46.25
E	.32	.48	.43	1.23	0.00	0.00	0.00	0.00
F	.04	.01	.03	.07	0.00	0.00	.01	.01
G	5.18	1.66	13.54	20.38	0.00	0.00	0.00	0.00
M	.00	.00	.00	.01	0.00	0.00	0.00	0.00
N	.00	0.00	.00	.00	0.00	0.00	0.00	0.00
P	.34	.33	.21	.89	.29	.01	.19	.48
W	.00	.00	.02	.02	.02	0.00	0.00	.02
X	.26	.69	.60	1.55	.09	.02	.04	.14
6	3.38	4.82	4.29	12.49	8.78	7.36	12.08	28.15
*	26.33	20.74	52.93	100.00	32.09	24.37	43.54	100.00

AUTODIN-I TRAFFIC ANALYSIS (7 DAY SAMPLE) PAGE 6

MESSAGES TOTALS

AGENCY	*REGULAR TRAFFIC* LOCAL	AREA	INTER-AREA	ALL	*FLASH TRAFFIC* LOCAL	AREA	INTER-AREA	ALL
D	92485.00	17388.00	26686.00	136559.00	858.00	19.00	36.00	913.00
A	108869.00	97183.00	292778.00	458830.00	304.00	317.00	712.00	1333.00
B	53874.00	40363.00	100453.00	200690.00	242.00	59.00	192.00	493.00
C	146093.00	147775.00	247578.00	541446.00	1305.00	1269.00	1745.00	4319.00
E	8720.00	8378.00	6932.00	22062.00	0.00	0.00	0.00	0.00
F	1928.00	328.00	1206.00	3462.00	0.00	0.00	1.00	1.00
G	69469.00	67832.00	177731.00	295032.00	0.00	0.00	0.00	0.00
H	170.00	42.00	160.00	372.00	0.00	0.00	0.00	0.00
N	39.00	0.00	54.00	93.00	0.00	0.00	0.00	0.00
P	7034.00	8172.00	5423.00	20629.00	26.00	1.00	19.00	46.00
W	286.00	49.00	368.00	703.00	7.00	0.00	0.00	7.00
X	4875.00	11468.00	9558.00	25901.00	8.00	1.00	4.00	13.00
S	69713.00	113653.00	74936.00	258302.00	732.00	449.00	945.00	2126.00
*	561475.00	492629.00	909863.00	1963901.00	3482.00	2115.00	3654.00	9251.00

AUTODIN-I TRAFFIC ANALYSIS (7 DAY SAMPLE) PAGE 7

MESSAGES
AS PERCENT OF AGENCY TRAFFIC BY CLASS

AGENCY	*REGULAR TRAFFIC*				*FLASH TRAFFIC*			
	LOCAL	AREA	INTER-AREA	ALL	LOCAL	AREA	INTER-AREA	ALL
D	67.73	12.73	19.54	100.00	93.98	2.08	3.94	100.00
A	23.73	21.18	55.09	100.00	22.81	23.78	53.41	100.00
B	26.84	20.11	53.04	100.00	49.09	11.97	38.95	100.00
C	26.98	27.29	45.73	100.00	30.22	29.38	40.40	100.00
E	30.51	38.01	31.48	100.00	0.00	0.00	0.00	0.00
F	55.69	9.47	34.84	100.00	0.00	0.00	100.00	100.00
G	23.55	16.21	60.24	100.00	0.00	0.00	0.00	0.00
H	45.70	11.29	43.01	100.00	0.00	0.00	0.00	0.00
N	41.94	0.00	58.06	100.00	0.00	0.00	0.00	0.00
P	34.10	39.61	26.29	100.00	56.52	2.17	41.30	100.00
W	33.07	7.87	59.07	100.00	100.00	0.00	0.00	100.00
X	18.82	44.28	36.90	100.00	61.54	7.69	30.77	100.00
6	26.99	44.09	29.01	100.00	34.43	21.12	44.45	100.00
*	28.59	25.08	46.33	100.00	37.64	22.86	39.50	100.00

MESSAGES
AS PERCENT OF SYSTEM TRAFFIC BY CLASS

AGENCY	REGULAR TRAFFIC				FLASH TRAFFIC			
	LOCAL	AREA	INTER-AREA	ALL	LOCAL	AREA	INTER-AREA	ALL
D	16.47	1.53	2.93	6.95	24.64	.98	.99	9.87
A	19.39	19.73	27.78	23.36	8.73	14.99	19.60	16.41
B	9.60	8.19	11.78	10.22	6.95	2.79	5.25	5.33
C	26.02	30.00	27.21	27.57	37.48	60.00	47.76	46.69
E	1.20	1.78	.76	1.12	0.00	0.00	0.00	0.00
F	.34	.07	.13	.18	0.00	0.00	.03	.01
G	12.37	9.71	19.53	15.02	0.00	0.00	0.00	0.00
H	.03	.01	.02	.02	0.00	0.00	0.00	0.00
N	.01	0.00	.01	.00	0.00	0.00	0.00	0.00
P	1.25	1.66	.60	1.05	.75	.05	.52	.50
W	.04	.01	.04	.03	.25	0.00	0.00	.08
X	.87	2.33	1.05	1.32	.23	.05	.11	.14
6	12.42	24.07	8.24	13.15	21.02	21.23	25.86	22.98
*	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

AUTODIN-I TRAFFIC ANALYSIS (7 DAY SAMPLE) PAGE 9

MESSAGES
AS PERCENT OF TOTAL SYSTEM TRAFFIC

AGENCY	*REGULAR TRAFFIC*				*FLASH TRAFFIC*			
	LOCAL	AREA	INTER-AREA	ALL	LOCAL	AREA	INTER-AREA	ALL
D	4.71	.89	1.36	6.95	9.27	.21	.39	9.87
A	5.54	4.95	12.87	23.36	3.29	3.43	7.70	14.41
B	2.74	2.06	5.42	10.22	2.62	.44	2.08	5.33
C	7.44	7.52	12.61	27.57	14.11	13.72	18.86	46.69
E	.74	.43	.35	1.12	0.00	0.00	0.00	0.00
F	.10	.02	.06	.18	0.00	0.00	.01	.01
G	3.54	2.44	9.05	15.02	0.00	0.00	0.00	0.00
M	.01	.00	.01	.02	0.00	0.00	0.00	0.00
N	.00	0.00	.00	.00	0.00	0.00	0.00	0.00
P	.36	.42	.28	1.05	.28	.01	.21	.50
W	.01	.00	.02	.03	.08	0.00	0.00	.08
X	.25	.58	.49	1.32	.09	.01	.04	.14
6	3.85	4.79	3.82	13.15	7.91	4.85	10.22	22.98
*	28.59	24.08	46.33	100.00	37.64	22.86	39.50	100.00

LINE BLOCKS PER MESSAGE

AGENCY	REGULAR TRAFFIC				FLASH TRAFFIC			
	LOCAL	AREA	INTER-AREA	ALL	LOCAL	AREA	INTER-AREA	ALL
D	11.83	37.22	36.69	19.92	4.73	14.84	9.28	5.12
A	51.19	34.89	47.83	46.18	13.89	13.45	13.59	13.63
B	58.76	40.39	57.49	52.25	12.02	14.17	11.26	11.98
C	25.73	28.56	29.48	28.18	11.72	11.17	13.64	12.33
E	37.38	44.88	49.01	43.89	0.00	0.00	0.00	0.00
F	14.40	12.63	17.60	15.35	0.00	0.00	6.00	6.00
G	58.41	27.19	59.67	54.11	0.00	0.00	0.00	0.00
H	13.82	19.90	23.38	18.59	0.00	0.00	0.00	0.00
N	7.36	0.00	12.63	10.42	0.00	0.00	0.00	0.00
P	37.91	32.09	30.73	33.72	12.69	0.00	11.26	12.00
W	10.11	10.33	45.95	41.30	2.71	0.00	0.00	2.71
X	41.57	47.44	49.08	46.94	12.75	10.00	11.25	12.40
6	38.03	31.19	44.86	37.88	13.69	10.87	14.73	15.28
*	36.73	32.98	45.56	39.88	10.61	13.27	13.72	12.48

INPUT PARAMETERS

COSTS ($/YR)

SWITCH	43944160
CONUS TRUNKS	355992
OVRSEAS TRUNKS	1781988
TOTAL	46082140
ADU MEMORY	8788832
(ALPHA)	(0.20)

TECHNICAL FACTORS

AREA MEMORY CAPACITY	21060
AREA TRUNK TERMINATIONS	56
INTER-AREA TERMINATIONS	17

USAGE COST FACTORS

LINE BLOCKS	1.000
MESSAGES	0.000
FLASH WEIGHTS	0.000

SURCHARGES ($/UNIT)

	LOCAL	AREA	INTER
ALL	0.10	0.15	0.30
FLASH	0.00	0.00	0.00

SAMPLE CHARACTERISTICS

DAYS OF TRAFFIC: 7

NUMBER OF CONNECTIONS

SLOW	MED	HIGH	TOTAL
893	315	114	1322

VOLUME OF TRAFFIC

LBLKS	MSGS	LBLK/MSG
78319983	1963961	39

TYPE OF TRAFFIC

	LOCAL	AREA	INTER-AREA
LBLKS	20621427	16246368	41522188
	561475	492623	909863

VOLUME OF FLASH TRAFFIC

LBLKS	MSGS	LBLK/MSG
115162	9251	12

RATE ANALYSIS

COST ALLOCATION ($/YR)

UTILIZATION	38146317
CONNECTIVITY	7935823
TOTAL	46082140

ACCESS CHARGES ($/MO)

BASE CHARGE	93.01
SLOW SPEED	279.04
MED SPEED	837.11
HIGH SPEED	1302.17

UTILIZATION RATES ($/UNIT)

	LOCAL	AREA	INTER AREA
LBLKS	0.0035	0.0038	0.0047
MESSAGES	0.1000	0.1500	0.3000
WEIGHTS	1.0000	1.0000	1.0000

IDA AUTODIN COST ALLOCATION MODEL OUTPUT
(ANNUAL BASIS)

BACKBONE CHARGES BY AGENCY

AGENCY	AGENCY CHARGES UTILZATN	CONNEC	TOTAL	PERCENT BREAKDOWN (WITHIN AGENCY) UTILZATN	CONNEC	CHARGES AS PERCENT OF TOTAL UTILZATN	CONNEC	TOTAL
D	1601263	562539	2163803	.74	.26	4.20	7.09	4.70
A	9952754	2417580	12370334	.80	.20	26.09	30.46	26.84
B	4584868	1338263	5923131	.77	.23	12.02	16.86	12.85
C	9089719	1632927	10722646	.85	.15	23.83	20.58	23.27
E	412359	92640	504999	.82	.18	1.08	1.17	1.10
F	42488	123893	166381	.26	.74	.11	1.56	.36
G	7116152	412975	7529128	.95	.05	18.65	5.20	16.34
M	5219	10045	15264	.34	.66	.01	.13	.03
N	1265	10045	11311	.11	.89	.00	.13	.02
P	326493	220998	547491	.60	.40	.86	2.78	1.19
W	11842	13394	25236	.47	.53	.03	.17	.05
X	524476	100453	624930	.84	.16	1.37	1.27	1.36
6	4477417	1000070	5477487	.82	.18	11.74	12.60	11.89
TOTAL	38146317	7935823	46082140	.83	.17	100.00	100.00	100.00

IDA AUTODIN COST ALLOCATION MODEL OUTPUT (concluded)
(ANNUAL BASIS)

APPENDIX C

SIMULATION PROGRAM DOCUMENTATION

SIMULATION PROGRAM DOCUMENTATION

The IDADIN computer model, the IDA version of the DCA automated AUTODIN Costing Model, consists of two Fortran programs on cards and various data files residing on both cards and tape. Described in this appendix are (1) the coding scheme and processing sequence for model operation, (2) the structure and programming logic of the Fortran routines, and (3) the formats of the various data files and user-defined input parameters. Sample output and listings of the Fortran programs DNCOSTCD and IDADIN are included.

A. CODING SCHEME FOR MODEL OPERATION

The DCA AUTODIN I system is a computer-controlled "store and forward" digital communications network that receives, stores, and transmits data to predetermined addresses on a worldwide basis. The 17 interconnected store-and-forward stations (computers) in the network are referred to as AUTODIN Switching Centers (ASCs) or, for convenience, "switches." Authorized users access the system from terminals or computers by means of circuits or channels continuously connecting them to a particular ASC. Each connection, a unique channel-switch combination is referred to as a system tributary and, depending on the speed of the transmitting equipment used, is classified as slow (transmits at 75, 150, or 300 baud), medium (600-1200 baud) or high (2400-4800 baud). Because of these varying transmission speeds, the Central Processing Unit (CPU) of each switch is augmented by the additional memory capacity of the Accumulation and Distribution Unit (ADU) which (1) stores

incoming messages until the CPU can handle them, and (2) matches the output rate to that of the receiving equipment. The following codes, based on the features of the AUTODIN network just described, are associated with each AUTODIN message transmission for cost accounting purposes.

(1) Program Designator Code (PDC). A four-character alphanumeric code consisting of the subscriber agency code (initial character) and the program-within-agency code (remaining three characters). Currently, there are 1300 subscribers accounting for 150 programs of 13 user agencies.

(2) Tributary Code. A combined code consisting of a three-character alphanumeric originating switch name and a three-character alphanumeric originating channel name (currently 1300 access lines among 17 switches).

(3) Routing Indicator (RI) Code. A six-character alphanumeric code that identifies either the origin or destination circuit/terminal for the message transmission. This code is available but not used in IDADIN processing.

(4) Values for weighting ADU memory costs by speed class of access line. Weights of 3, 9, and 14 are used for low, medium, and high connections, respectively.

B. PROCESSING SEQUENCE FOR MODEL OPERATION

A schematic of the overall processing sequence for the IDADIN model is shown in Figure C-1. Data for AUTODIN traffic are collected over all the ASCs in "traffic files," each file (a "raday") representing one day's traffic. The traffic files and the AMIE Extract File are first sequenced by utility sort for input to the preliminary program DNCOSTCD. During this procedure the records of the Traffic File simultaneously are reduced in length to seven elements of information, sequenced in ascending order of originating switch name, originating channel name, and RI code, and, if more than one file, merged into a single file. Then, by matching the sequenced Traffic File to both the sequenced AMIE Extract File and the Switch Name File, DNCOSTCD produces as output the STASUB File, a revised traffic file

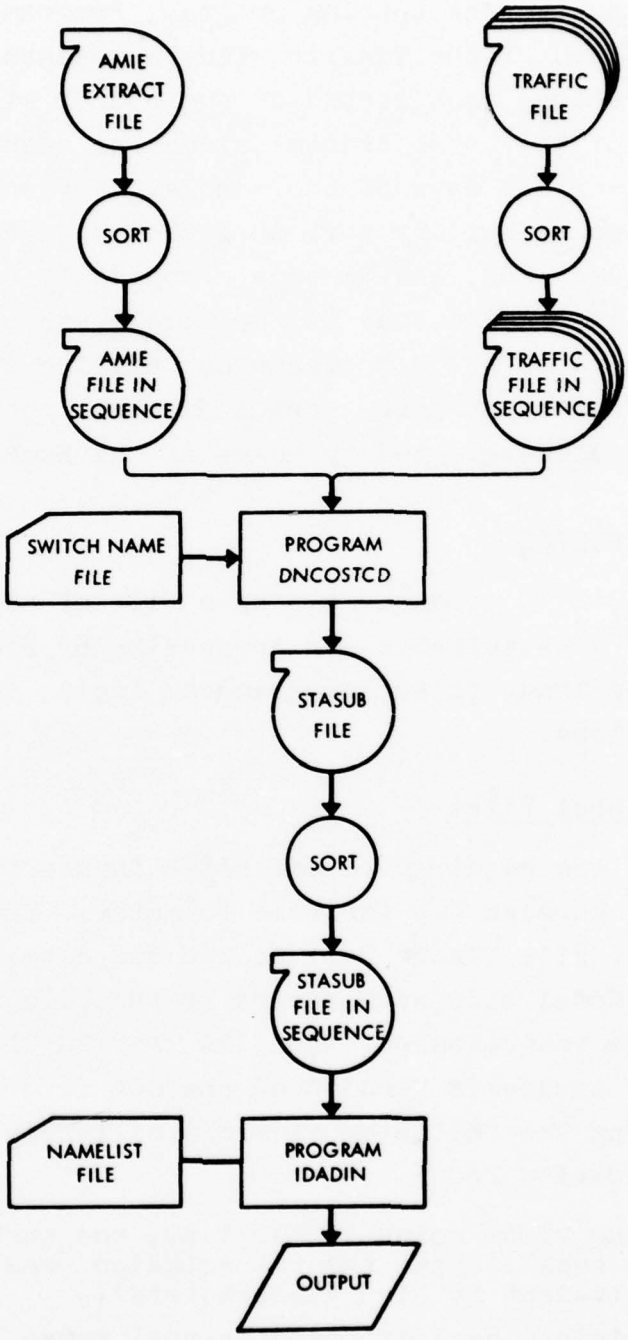


Figure C-1. SCHEMATIC OF PROCESSING SEQUENCE FOR THE IDADIN COSTING MODEL

suitable for input to the costing program, Program IDADIN. Whereas each record of the Traffic File represents a single message transmission, each record of the STASUB File represents an aggregation of the total transmissions for each tributary on the system over all days of the sample. After the STASUB File is sequenced by utility sort in ascending order of switch name, channel name, PDC, and RI code, Program IDADIN processes it to produce, as final output of the model, various costing analyses pertinent to AUTODIN subscriber billing charges. As will be described, input parameters and output options for Program IDADIN are user-selected by means of the Namelist File.

C. PROGRAM DNCOSTCD

Program DNCOSTCD produces a single file of subscriber-coded AUTODIN traffic data suitable for processing by Program IDADIN. A description of input files, programming logic, and DNCOSTCD subprograms follows.

1. DNCOSTCD Input Files

Four files are required to establish inputs to DNCOSTCD (see Tables C-1 through C-4 for file formats). The DCA Sorted Assemble Traffic File (Table C-1) is the raw data base for the IDADIN Costing Model with each record of the file representing a single message transmission. The IDA Traffic File (Table C-2) is a sequenced, condensed version of the DCA file with each record containing the following elements of information relevant to the IDADIN Costing Model:

(1) The line block count (LBC), i.e., the number of line blocks constituting the transmission (one line block is equivalent to eighty characters).

(2) The originating switch and channel names (the origin tributary).

(3) The destination switch and channel names (destination tributary).

(4) The message precedence (priority).

Table C-1. FILE FORMAT FOR DCA SORTED ASSEMBLE TRAFFIC FILE

Field	Record Position	Fortran Variable Name	Format	Item
1	1-3	W(1)	A3	Raday (not used)
2	4	W(2)	A1	Precedence (Z = FLASH)
3	5	W(3)	A1	Security (not used)
4	6	W(4)	A1	LMF (not used)
5	7-9	W(5)	A3	Origin Switch Name
6	10-12	W(6)	A3	Origin Channel Name
7	13-15	W(7)	A3	Dest. Switch Name
8	16-18	W(8)	A3	Dest. Channel Name
9	19-22	W(9)	A4	OSSN (not used)
10	23-25	W(10)	I3	Line Block Count
11	26-29	W(11)	I4	Time of Transmission (not used)
12	30-33	W(12)	A4	Speed of Service (not used)
13	34-39	W(13)	A6	Origin RI

File Name: Sorted Assemble Traffic File (Tape Input)
Source: Defense Communications Agency

Table C-2. FILE FORMAT FOR IDA TRAFFIC FILE

Field	Record Position	Fortran Variable Name	Format	Item
1	1-3	W(1)	A3	Destination Channel Name
2	4	W(2)	A1	Precedence (Z = FLASH)
3	5-7	W(3)	A3	Origin Switch Name
4	8-10	W(4)	A3	Origin Channel Name
5	11-13	W(5)	A3	Destination Switch Name
6	14-16	W(6)	I3	Line Block Count
7	17-22	W(7)	A6	Origin RI

File Name: IDA Traffic File
Fortran Reference: TAPE 1 (Tape Input)
Source: Institute for Defense Analyses

The AMIE Extract File, Table C-3, a condensed version of the DCA Auditing Management Index File (AMIE), contains a list of PDCs and bauds (transmission speeds) associated with each tributary appearing on the Traffic File. These two files are matched on tributaries, i.e., on switch name/channel name combinations. Similarly, the Switch Name File, Table C-4, contains a geographic location code (C = CONUS, E = Europe, P = Pacific) for each of the 17 switches on the AUTODIN system. This file is matched to the Traffic File by switch name.

Table C-3. FILE FORMAT FOR AMIE EXTRACT FILE

Field	Record Position	Fortran Variable Name	Format	Item
1	1-3	AMIE(1)	A3	Origin Switch Name
2	4-6	AMIE(2)	A3	Origin Channel Name
3	7-10	AMIE(3)	A4	PDC
4	11-14	AMIE(4)	A4	Baud Rate

File Name: AMIE Extract File
Source: Defense Communications Agency
Fortran Reference: TAPE 1 (Tape Input)

Table C-4. FILE FORMAT FOR SWITCH NAME FILE

Field	Card Column	Fortran Variable Name	Format	Item
1	1-3	J	A3	Switch Name
2	4	K	A1	Geographical Area

File Name: Switch Name File
Fortran Reference: TAPE 5 (Card Input)

2. DNCOSTCD Programming Logic

By sequential matching of the ordered records of the input files described above, Program DNCOSTCD both revises and aggregates the records of the IDA Traffic File in the following four ways. (1) The baud and PDC from an AMIE Extract File record and the origin switch name, origin channel name, and RI from a matching Traffic File record form the first five fields of the revised record. (2) The originating switch name and geographic location of the transmission are compared to the destination switch name and geographic location. If the originating and destination switch names match, the LBC for the record is designated local traffic and if the message has priority (a "FLASH" message) the LBC is also designated as local FLASH data. Similarly, if only the geographic areas match, the LBC is designated as area traffic or FLASH area traffic. If neither switch nor geographic areas match, the LBC is designated inter-area or FLASH inter-area. Thus, the LBC for a given transmission is assigned one of the next six fields on the new record according to its geographic designation and precedence category. (It should be noted that the count of FLASH LBCs on any record is to be considered a subset of the total LBC count.) (3) A new traffic record is read. If the origin switch name/channel name combination contained on the record does not match that on the AMIE Extract record just processed, a new AMIE record is read (thus effecting the next match) and a new tributary record is constructed as described. If the next tributary does match the preceding AMIE record, however, the LBC counts are added into the counts just established for the preceding match. (4) Finally, the remaining six fields of the tributary record are used to record the number of message transmissions occurring for the tributary. The counts are incremented with each match of a traffic record to a preceding AMIE record, and their placement on the record corresponds to the geographic designation-precedence categories used for the LBC counts with the exception

that an additional field is used to tally total number of messages for the tributary.

A more specific description of this processing sequence is shown in the flow chart in Figure C-2. Additional information is provided by means of comment cards on the DNCOSTCD Program Listing.

3. DNCOSTCD Subprograms

Two short subroutines are used in DNCOSTCD processing. Subroutine SORT is called to sort the input switch name location codes into collating sequence. The Integer Function Subprogram LOC is called in order to match both switch names on a given record with the sorted switch name file, thus allocating LBCs to the proper record field. In addition to SORT and LOC, DNCOSTCD also uses two input file detection devices resident in the IDA CDC computer system program library. INCK allows a return to execution if illegal characters are encountered during a Fortran BCD input read rather than terminating the program with an error message. The EOF device is used to detect the end-of-file mark on the various input files and to branch program control to the appropriate point in the processing sequence.

4. DNCOSTCD Sample Output

Two types of printed output are produced in DNCOSTCD processing. Table C-5 shows a listing of the 17 switch name codes in the Switch Name File and their corresponding geographic identifiers. Table C-6 shows a formatted listing of the contents of the STASUB File produced as the primary output of the program.

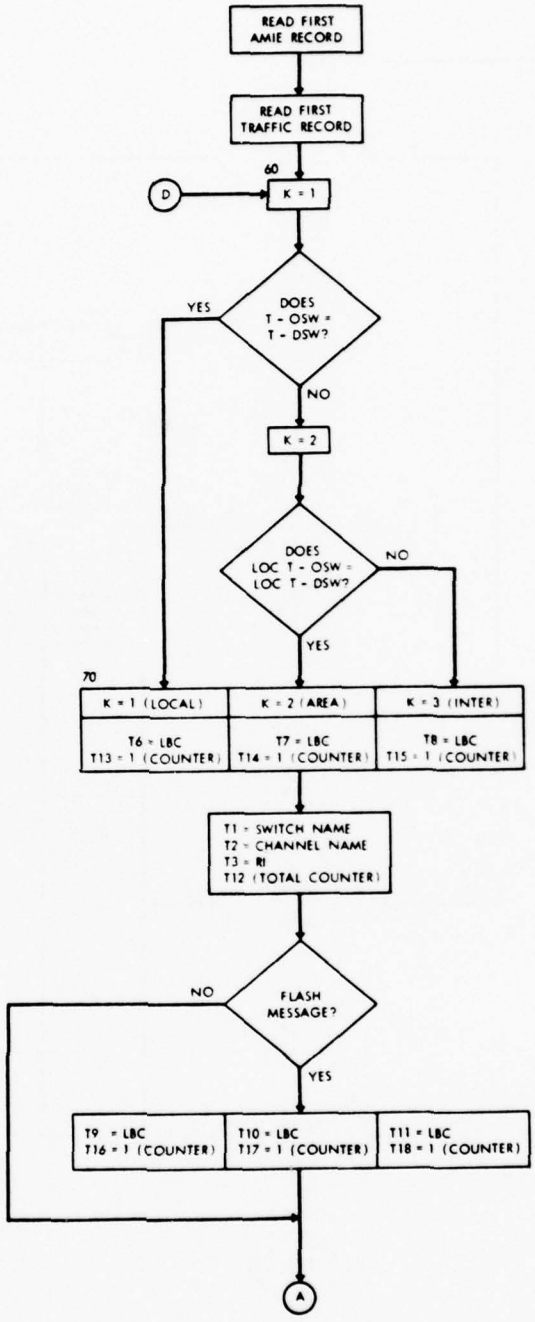


Figure C-2. PROCESSING SEQUENCE FOR PROGRAM DNCOSTCD
(continued on next page)

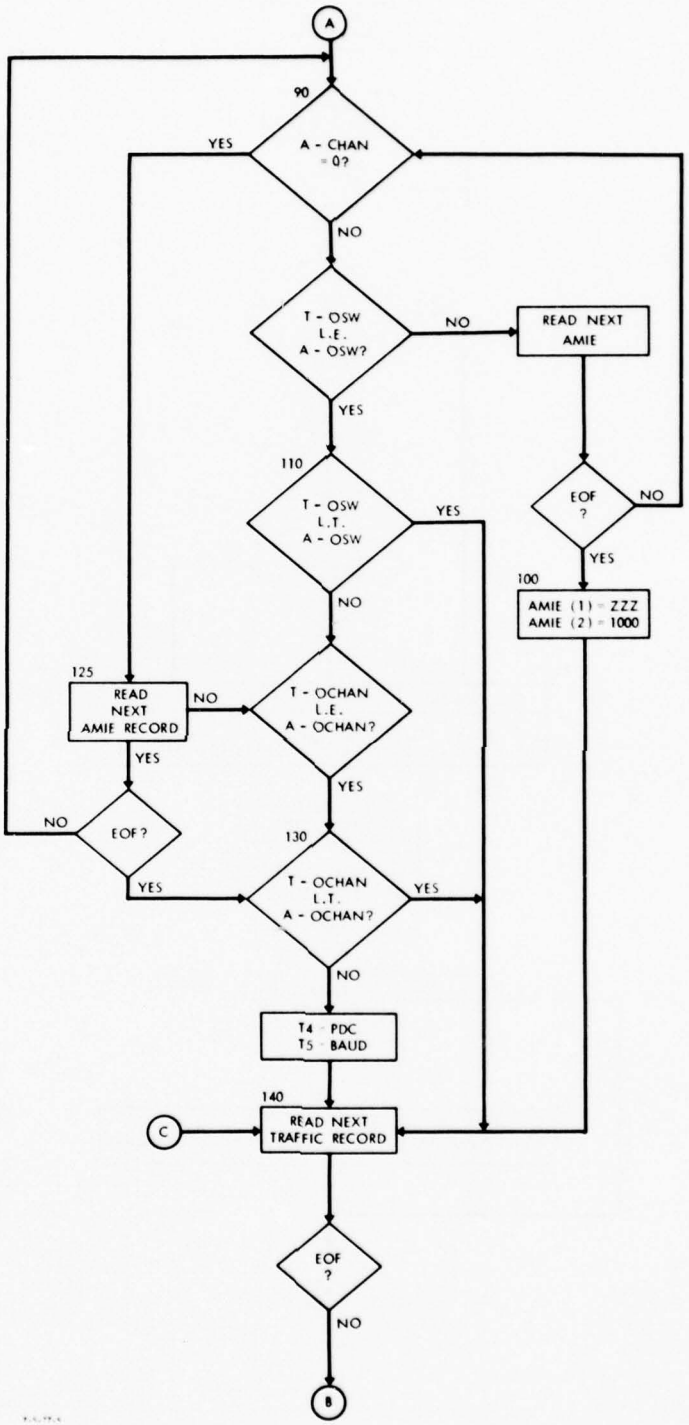


Figure C-2 (continued)

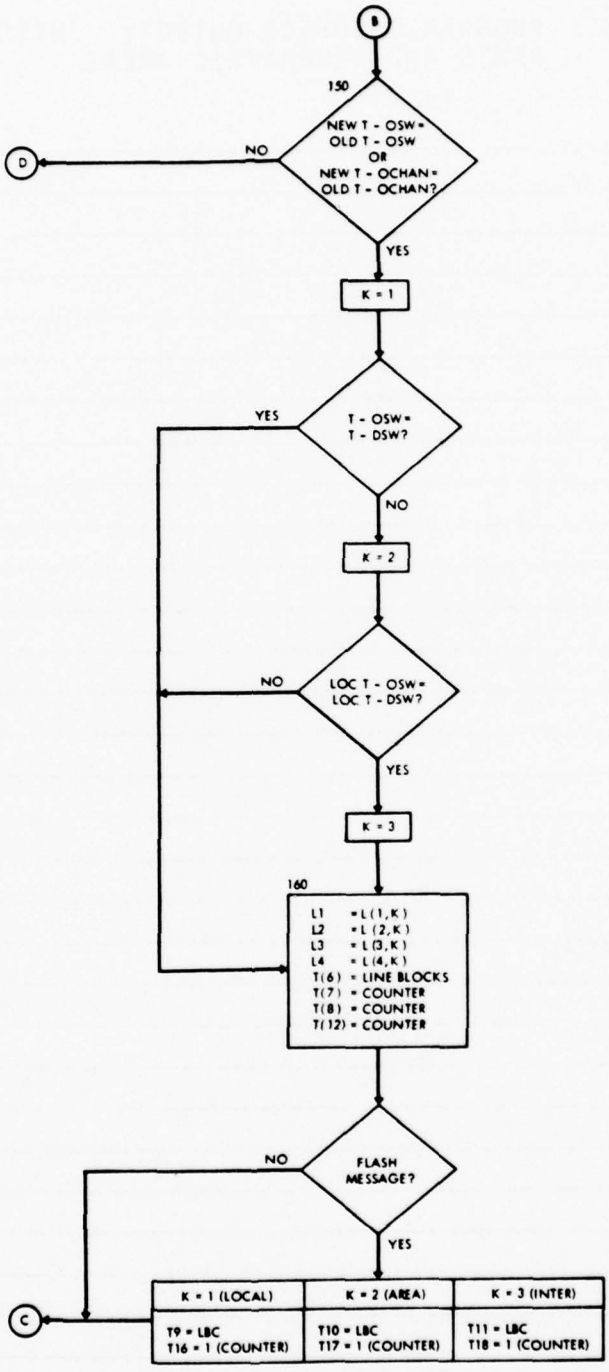


Figure C-2 (concluded)

Table C-5. PROGRAM DNCOSTCD OUTPUT: SWITCH NAMES AND GEOGRAPHIC AREAS

```
SWITCH DESIGNATIONS ARE
    UAD     P
    UAK     P
    UAO     P
    UCI     C
    UCL     C
    UDO     E
    UEB     C
    UED     C
    UEO     C
    UFL     E
    UFT     E
    UHH     P
    UHJ     P
    UHN     P
    UWJ     C
    UWN     C
    UWT     C

RETURN FROM INPUT ERROR.
```

Table C-6. PROGRAM DNCOSTCD OUTPUT: FORMATTED LISTING OF THE STASUB FILE

T1/T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18
UAD007	***UAN	CC7Y	0300	36450	20818	56755	3102	758	4349	3312	1110	575	1427	175	44	243
UAD008	***UAN	PR2A	0300	6738	29418	12087	0	0	0	1747	269	978	508	0	0	0
UAD010	***UAN			3927	44	27	26	0	0	1268	1250	11	7	0	0	0
UAD021	MAN	CC7Y	0300	8097	20053	21628	78	142	142	2928	448	1226	1055	3	7	7
UAD027	UADJKA	AREA	0300	8236	11820	13633	116	50	287	1350	298	450	493	18	6	38
UAD025	MAR	AAV4	0600	7798	6387	17012	247	266	266	1164	268	924	472	9	10	10
UAD026	UADKEA	ABEA	1200	3535	100896	36524	0	0	0	2986	153	1530	1303	0	0	0
UAD030	MMO	CC7Y	1200	10437	18005	26203	0	0	0	2858	443	737	1578	0	0	0
UAD037	MAK	ABEA	0075	400	56	34	0	0	0	39	33	4	2	0	0	0
UAD039	MAK			12	0	0	0	0	0	1	1	0	0	0	0	0
UAD044	MAN	CC7Y	0075	28	0	0	0	0	0	0	7	1	0	0	0	0
UAD042	UADFMA			2536	768	2172	0	0	0	76	35	11	38	0	0	0
UAD043	UADFBA	ACOM	0075	25361	16928	37020	0	0	0	1763	544	300	828	0	0	0
UAD044	UADLEA	AMAN	0075	198	2553	250	0	0	0	127	50	59	18	0	0	0
UAD045	UMA	CC7Y	0075	77	133	14	0	0	0	16	4	11	1	0	0	0
UAD052	***UAN	PL2J	0075	304	1845	2920	0	0	0	203	53	75	75	0	0	0
UAD053	***UAN	CC7Y	0075	397	209	165	0	0	0	46	13	21	12	0	0	0
UAD054	***UAN	EWUR	0075	2282	2773	1198	0	0	0	208	103	72	33	0	0	0
UAD058	UADKHA	CC7Y	0300	10114	15162	10477	0	0	0	1294	186	615	493	0	0	0
UAD062	UADMTA	AAV5	0300	3701	7456	6182	4	4	4	1204	160	701	343	1	1	1
UAD079	***UAN	AAA2	0600	17698	65023	35232	184	278	252	4591	474	2901	1316	8	15	14
UAD080	***UAN	PR2A	0600	515	254	66	0	0	0	118	87	24	7	0	0	0
UAD082	***UAN			5156	22	35	29	0	0	1667	1452	6	9	0	0	0
UAD088	MAN	CC7Y	0075	718	718	1440	0	0	0	192	43	52	97	0	0	0
UAD089	UADOPA	PR2H	0075	2822	691	2944	14	0	0	381	215	34	132	1	0	0
UAD098	UADUPA	ECHL	0075	30	0	20	0	0	0	10	6	0	4	0	0	0
UAD091	***UAN	CC7H	0075	349	94	352	0	0	0	44	24	7	13	0	0	0
UAD093	***UAN	CC7Y	0075	11033	14145	10206	0	0	0	854	269	323	262	0	0	0
UAD103	UADCOA			723	0	0	0	0	0	357	357	0	0	0	0	0
UAD110	***UAN			42	0	0	42	0	0	6	6	0	0	0	0	0
UAD117	UADJMA	PR2J	2400	31839	23609	23142	0	0	0	1195	341	584	358	0	0	0
UAD119	UADJVA	CC7Y	0300	1365	1586	12346	0	0	19	851	32	63	256	0	0	1
UAD120	UADLTA	CC7Y	0300	1916	1687	3417	0	0	0	406	79	131	196	0	0	0
UAD124	***UAN			663	9	9	339	0	5	70	68	0	2	49	0	1
UAD129	***UAN	ALAD	0150	4069	6729	12460	0	0	0	312	114	161	37	0	0	0
UAD130	***UAN			3073	18	4	17	0	0	979	974	4	1	3	2	0
UAD131	***UAN	ALAD	0150	2743	4224	1116	0	0	0	276	77	149	50	0	0	0
UAD134	***UAN	AAA1	0150	817	712	625	0	0	0	163	57	44	42	0	0	0
UAD135	***UAN	AAA2	0300	9302	13670	11999	207	240	319	1474	420	566	488	14	20	22
UAD136	***UAN			769	1234	1264	0	0	0	119	21	68	38	0	0	0
UAD137	***UAN			334	964	811	0	0	0	44	10	21	13	0	0	0
UAD140	MAI	PR2A	2400	8465	6234	3036	0	0	0	537	178	196	163	0	0	0
UAD142	UAG	PR2A	0600	536	1756	6606	0	0	0	309	28	121	250	0	0	0
UAD149	UAJ	CC7Y	0300	7	0	0	0	0	0	1	1	0	0	0	0	0
UAD154	UADCSA			19816	4877	6125	287	0	0	1085	799	87	199	31	0	0
UAD161	UADLUA	AREA	0075	88	2267	261	0	0	0	462	21	487	34	0	0	0
UAD165	UADTPA	PR2H	0075	122	0	166	32	0	168	28	13	0	15	3	0	18
UAD167	UADLLA	CC7Y	0075	349	86	5206	0	0	0	341	22	18	329	0	0	0
UAD168	***UAN			3	0	0	0	0	0	1	1	0	0	0	0	0
UAD224	***UAN			9921	5315	1946	0	0	0	1298	451	419	328	0	0	0
UAD225	***UAN			33	0	17	33	0	17	4	3	0	1	3	0	1
UAD226	***UAN			436	7	9	34	0	0	38	34	1	1	2	0	0
UAK003	***UAK	0LAD	0150	20335	54170	26451	0	0	0	5028	1265	2928	1341	0	0	0
UAK006	UAKGBA	PR2H	0300	365	72	106	65	0	13	36	27	2	7	5	0	1
UAK007	UAKKMA	AREA	1200	8674	37285	28273	77	44	66	2575	324	1045	1204	2	4	0
UAK012	UAG	PR2H	2400	26945	49354	23488	0	0	0	1859	453	835	371	0	0	0
UAK017	UAKMLA	AREA	0600	4084	35558	18099	0	0	4	985	160	381	444	0	0	1
UAK018	UAKUJA	PR2H	0075	480	253	691	0	0	0	89	63	14	12	0	0	0
UAK019	UAKUPA	PR2H	0075	1995	143	254	0	0	0	147	124	11	17	0	0	0
UAK01P	UAKHPA	PR2H	0075	593	1126	209	0	0	0	151	88	41	22	0	0	0

**** UNCLASSIFIED ****

PAGE NO. 000012

C. PROGRAM IDADIN

The purpose of the IDADIN computer model is to provide a method of allocating costs to the particular users having access to the AUTODIN system. Using a sample of message traffic, Program IDADIN performs a rate analysis and calculates backbone charges by user agency. In addition, various tables of possible cost allocations are generated. A description of the IDADIN input files, programming logic, cost model algorithm, and subprograms follows. Sample output is included.

1. IDADIN Input Files

Two files are required inputs to Program IDADIN. The STASUB File (see Table C-7 for file format) contains for each tributary on the system its user identification codes (PDC and origin switch and channel names), transmission speed (baud), and volume of traffic (line block and message counts) over all days of the traffic sample. The second file is input on cards and stored as array LIST by means of the Fortran Namelist statement. This technique is employed in Program IDADIN to enable the user to vary cost allocation model input parameters and to select output options for each iteration of the cost algorithm. The array LIST is established by the user in the following manner. A value is selected for each variable specified by the Namelist statement (see Table C-8). The variable names and values are then punched on input cards in "free format," i.e., they are punched in the order specified by the Namelist statement but without regard to the field position. (Similarly, when the list is input or output, no format specifications are required.) Each input list must begin with a $ in Column 2 of the first card, followed immediately by the word LIST with no embedded blanks. A $ must also follow the last variable in the list. The data items, separated by commas, may be in any of three forms:

Table C-7. FILE FORMAT FOR STASUB FILE

Field	Record Position	Fortran Variable Name	Format	Item
1	1-3	W(1)	A3	Originating Switch Name
2	4-6	W(2)	A3	Originating Channel Name
3	7-12	W(3)	A6	Routing Indicator Code
4	13-16	W(4)	A4	Program Designator Code
5	17-20	W(5)	I4	Transmission, Speed, baud
6	21-29	W(6)	I9	Number of Local Line Blocks
7	30-38	W(7)	I9	Number of Area Line Blocks
8	39-47	W(8)	I9	Number of Inter-area Line Blocks
9	48-53	W(9)	I6	Number of Local FLASH Line Blocks
10	54-59	W(10)	I6	Number of Area FLASH Line Blocks
11	60-65	W(11)	I6	Number of Inter-area FLASH Line Blocks
12	66-72	--	--	Blank
13	73-80	W(12)	I8	Total Number of Messages
14	81-89	W(13)	I9	Number of Local Messages
15	90-98	W(14)	I9	Number of Area Messages
16	99-107	W(15)	I9	Number of Inter-area Messages
17	108-116	W(16)	I9	Number of Local FLASH Messages
18	117-125	W(17)	I9	Number of Area FLASH Messages
19	126-134	W(18)	I9	Number of Inter-area FLASH Messages

File Name: STASUB File

Fortran Reference: TAPE 1 (Tape Input)

Table C-8. NAMELIST FILE INPUT VARIABLES

Variable Name	Output Item	Value Producing Sample Output[1]	Definition
SWCOST	Switch Cost, $	845080	This value x 52 is the approximate lease and O&M costs for all switching centers in FY 78.
MCOST	ADU Memory Cost, $	169016	This value x 52 is the estimate of ADU lease costs. Nine leased switches assuming two ADUs per switch.
TRKC	Number of Area Trunk Terminations	56	Count of leased switch interconnections.
TRKI	Number of Inter-area Terminations	17	Number of trunk terminations at leased switches from overseas.
TRIC	CONUS Trunk Costs, $	6846	Defined as cost of all area trunks, i.e., trunks connecting switches in same charging area (CONUS, Europe, etc.). Value here x 52 is for CONUS trunks only.
TROC	Overseas Trunk Costs, $	34269	Defined as cost of trunks connecting switches in different areas. Value used here is for CONUS trunks only.
LBLKS	Area Memory Capacity, Line Blocks	21060	Line blocks of ADU memory is all leased switches assuming eighteen ADUs and eight quadrants of memory per ADU (Hawaii switch is included with CONUS).
BRKDWN	n.a.	.TRUE.	Output Control Variable. If BRKDWN = .TRUE., output produced for AUTODIN Costs by Program Designation Code for utilization, connectivity, and total costs. If BRKDWN = .FALSE., output suppressed.
SPDBLK	Not shown in output	3, 9, 14	Weights (slow, medium, high) used to calculate monthly basic charge for connectivity.
FLASH	Usage Cost Factor: FLASH Weights	0.0	Single weight applied to all FLASH messages (may take on any value).
BLOCKS	Usage Cost Factor (if line blocks, 1.0; if messages, 0.0)		A 0.0 value for BLOCKS is equivalent to assigning all usage charges on a message basis. A 1.0 value assigns all message charges on a line block basis. Calculated after all surcharges have been deducted. Values may range between 0 and 1.
MSGCHG	Surcharges: local, area, inter-area	.10, .15, .30 (0.0 for FLASH)	These surcharges are applied on a per-message basis and subtracted from costs to be collected through usage before calculation of line block and message rates. May take on any value.
MSGWTS	Not shown	1, 1, 1	A set of weighting factors for local, area, and inter-area non-FLASH messages. May take on any value.
PRTTA	n.a.	.TRUE.	Output Control Variable. If PRTTA = .TRUE., output produced for subroutines CNCT and ATA. If PRTTA = .FALSE., output suppressed.

[1]See IDA AUTODIN Cost Allocation Model Output.

$$v = c$$

$$a = d_1,\ldots,d_j$$

$$a(n) = d_1,\ldots,d_m$$

where v is a variable name, c a constant, a an array name, and n an integer subscript. The d_i are simple constants or repeated constants of the form k*c, where k is the repetition factor. For example, $ SWCOST = 845080, MCOST = 169016, TRKC = 56,..., PRTTA = .TRUE.$. A special feature of the use of the Namelist in IDADIN is that those variables shown in Table C-8 as already containing values are used as default inputs. To use them by default, the user merely omits them from his input list. An additional feature is that the output from Subroutines CNNCT and ATA can be suppressed by resetting the logical variable PRETTA to .FALSE.. Similarly, the output for AUTODIN I costs by program designator code can be suppressed by setting the logical variable BRKDWN to .FALSE..

2. IDADIN Processing Sequence

Program IDADIN processing proceeds as follows: (1) the Namelist File is read in, thus setting up array LIST with an ordered list of model parameters. (2) Subroutine Sample is called to place into the labeled common block PCA an alpha-numeric representation of the number of days (IOPT) in the traffic sample. This provides a convenient way to display the sample size in all the output headers. (3) Next, if the user has not suppressed them by means of the input control variable PRTTA, two subroutines are called: Subroutine CNNCT calculates and outputs a breakdown of total ADU memory utilization by switch and connectivity speed class (see Table C-9). Subroutine ATA is called to calculate an AUTODIN I Traffic Analysis (7-day sample). The output of this analysis (see Appendix B) is organized in the following manner. The first table, "System Access Analysis," presents by agency the number of connections

Table C-9. PROGRAM IDADIN OUTPUT: ADU MEMORY UTILIZATION, LINE BLOCKS, BY SWITCH AND CONNECTIVITY SPEED CLASS

Switch	Slow	Medium	High	Percent
UEB	79	21	8	46
UED	51	19	17	49
UEO	61	24	18	56
UCI	47	20	13	43
UCL	57	37	10	56
UWJ	47	24	8	41
UWM	73	29	6	49
UWT	77	33	17	66
UHH	39	12	3	23

by speed class and the percent each value is of the agency, the system, and the total. The next nine tables are a breakdown by agency for local, area, inter-area, and total traffic (both regular and FLASH) for the following items:

(a) total line blocks
(b) line blocks as percent of agency traffic
(c) line blocks as percent of system traffic
(d) line blocks as percent of total system traffic
(e) total messages
(f) messages as percent of agency traffic
(g) messages as percent of system traffic
(h) messages as percent of total system traffic
(i) line blocks per message.

The remaining table (see sample in Table C-10) is a summary of all the preceding tables by PDC code rather than by agency. (4) Using the parameters specified in the Namelist File, all cost factors are calculated. Then, Subroutine TAB is called to print the report of the resulting cost allocation by Program Designator Code (see Table C-11). (5) Subroutine OUTPUT is

Table C-10. PROGRAM IDADIN OUTPUT: TRAFFIC ANALYSIS SUMMARY TABLE BY PDC CODE

AUTODIN-I TRAFFIC ANALYSIS (7 DAY SAMPLE) PAGE 11

PROGRAM DESIGNATOR CODE	REGULAR TRAFFIC: LINE BLOCKS MESSAGES LINE BLOCKS PER MESSAGE LOCAL	AREA	INTER	ALL	FLASH TRAFFIC: LINE BLOCKS MESSAGES LINE BLOCKS PER MESSAGE LOCAL	AREA	INTER	ALL	CONNECTIONS: SLOW	MEDIUM	HIGH	ALL
	1093984	647114	979030	2720137	4055	282	334	4671				
	92485	17388	26686	136559	858	19	36	913				
	12	37	37	20	5	15	9	5	165	1	0	166
AAAI	100	0	0	100	0	0	0	0				
	10	0	0	10	0	0	0	0				
	10	0	0	10	0	0	0	0	1	0	0	1
AAA1	5336	4933	6971	17240	152	90	221	463				
	487	297	347	1131	10	6	15	31				
	11	17	20	15	15	15	15	15	6	0	0	6
AAA2	43191	140047	88000	271238	553	1040	1315	2908				
	2128	6247	3754	12129	43	75	100	218				
	20	22	23	22	13	14	13	13	5	2	0	7
AAFB	80	49	152	281	0	0	0	0				
	16	6	14	36	0	0	0	0				
	5	8	11	8	0	0	0	0	1	0	0	1
AAFD	40087	98560	113217	251864	210	254	418	882				
	1820	3386	3810	9016	18	22	36	76				
	22	29	30	28	12	12	12	12	3	3	0	6
AAFE	10055	2702	18487	31244	0	0	0	0				
	503	83	683	1269	0	0	0	0				
	20	33	27	25	0	0	0	0	8	2	0	10
AAFF	209	71	147	427	0	0	0	0				
	50	7	12	69	0	0	0	0				
	4	10	12	6	0	0	0	0	1	0	0	1
AAFI	839	6	3677	4519	0	0	0	0				
	119	0	84	203	0	0	0	0				
	7	0	44	22	0	0	0	0	1	0	0	1
AAFL	278	251	352	881	0	0	0	0				
	67	20	33	120	0	0	0	0				
	4	13	11	7	0	0	0	0	1	0	0	1

Table C-11. PROGRAM IDADIN OUTPUT: SUMMARY OF AUTODIN I COSTS FOR UTILIZATION AND CONNECTIVITY BY PROGRAM DESIGNATOR CODE

AUTODIN-I TRAFFIC ANALYSIS (7 DAY SAMPLE) PAGE 28

AUTODIN-I COSTS BY PROGRAM DESIGNATOR CODE

PDC	UTILIZATION	CONNECTIVITY	TOTAL	PDC	UTILIZATION	CONNECTIVITY	TOTAL	PDC	UTILIZATION	CONNECTIVITY	TOTAL
	22328	10818	33146	ARLA	9329	3069	12398	FBBV	10	64	74
AAA1	1	64	65	ARP1	112	129	241	0A8C	104	193	297
AAA1	147	386	533	BBCA	18	365	383	0A8D	309	193	502
AAA2	2105	708	2894	BBCB	1014	365	1379	0A8E	159	193	352
AAFB	3	64	67	BBCC	1253	193	1446	0A8F	142	193	335
AAFD	2236	773	3009	BBCF	2227	558	2785	0A8G	212	193	405
AAFE	309	902	1206	BBCH	84	64	149	0A8J	625	193	818
AAFF	3	64	68	BBCJ	64	258	322	0A8K	335	193	528
AAFI	51	64	115	BBCK	13	193	206	0A8M	586	193	779
AAFL	7	64	72	BBCM	84	580	663	0C8A	7652	601	8253
AAFS	1	64	66	BBCP	64	193	257	0E8A	628	301	929
AAF1	454	322	776	BBCR	368	514	883	0F8A	1108	193	1301
AAF2	302	580	882	BBCS	22151	2533	24684	0H8A	1348	301	1649
AAF3	323	773	1095	BBCT	9469	1159	10568	0L8A	2029	301	2329
AAF4	4	193	197	BBCV	21050	6976	28026	0N8A	4882	301	5182
AAF5	15	129	144	BBCX	45	64	109	0P8A	20484	902	21386
AAF6	47	258	305	BBCY	26012	7148	33160	0P8D	7104	301	7404
AAYA	14139	301	14439	BCCV	373	194	567	0R8A	564	193	757
AA9A	11469	1693	13621	BCCW	115	64	180	0S8A	89709	2404	92113
AA6C	29	64	94	BECL	638	601	1239	0S8B	25537	601	26138
AA6E	3904	3069	6973	BFCW	131	322	453	MJWU	65	193	258
AA6F	2901	193	3094	BLCA	11	193	204	NR2E	10	193	203
AA6G	6443	1202	7845	BLCW	1344	1867	3211	PBTK	166	64	230
AA6J	245	64	309	BNCL	15444	1266	16710	PB2A	12	64	76
AA6K	8248	601	8841	BSCS	57	65	121	PB2H	1	64	64
AA6L	3107	494	3601	CCOJ	22	64	86	PB2J	611	301	912
AA6M	552	451	1003	CC1A	1366	966	2332	PB2K	2202	1610	3812
AA6N	343	193	537	CC1N	1039	644	1683	PB2P	116	129	239
AA61	2303	837	3140	CC1C	4130	880	5010	PB2R	252	193	445
AA62	347	515	862	CC1D	32712	3391	36104	PB2S	224	601	825
AA63	22397	5473	27871	CC1E	7063	2902	10028	PB21	16	64	80
AA64	38317	3241	41558	CC1F	2394	773	3167	PB24	308	129	437
AA65	23988	2812	26800	CC1G	7410	816	8226	PB25	50	64	114
AA66	10415	2941	13355	CC1H	1680	773	2453	PB27	73	64	138
AA69	3456	1702	5237	CC1J	19255	2876	22131	PF2P	415	258	672
AA71	2924	193	3118	CC1K	7649	1867	9513	PF2R	29	64	93
AA72	2766	622	3389	CC1L	802	580	1381	PF2S	376	258	634
AA73	6428	429	6858	CC1M	14863	3842	18705	PL2A	92	64	97
AA74	1121	1030	2152	CC1N	934	580	1514	PL2J	43	64	108
AA85	3881	386	4267	CC1R	13866	3263	17129	PL2M	171	193	364
AA86	25	64	89	CC1W	5002	2603	7605	WEDA	8	129	136
AA87	12692	6203	18895	CC1X	137	129	266	WE8A	219	129	348
AA89	183	64	248	CC1Y	11294	3928	15222	XAAD	2020	64	2084
AA91	22	64	86	CIWD	6145	386	6531	XBDA	1007	258	1264
AA92	282	258	540	ECWC	5355	1073	6428	XBHD	53	193	246
AA93	486	258	744	EHUR	2123	644	2767	XCWD	9795	322	6477
AA94	2143	880	3023	EHWD	448	64	513	XDWD	1413	966	2379
AA95	118	64	182	FABV	136	1867	2004	XEDA	8	64	73
AA98	2000	1417	3417	FAHW	182	258	440	XEDR	26	64	90
AFR1	2	64	66	FAWJ	119	194	313	6B8A	79694	19232	98926

called to organize the first portion of a convenient summary of the cost allocation model in terms of the input parameters specified by the user, sample characteristics, and the rate analysis. (6) Control is returned to the main program to calculate and print out, as the final portion of the summary, the backbone charges by agency. (7) The final section of the program rewinds the STASUB File and processes and prints out the second user output option if specified, i.e., a full analysis by switch for each PDC (see Table C-12 for sample). At this point, a new namelist card(s), if any, is read in and processing starts again for another full run of the program. A more detailed description of the cost allocation model algorithm is described in the following section.

3. Cost Model Allocation Algorithm

The IDA AUTODIN Cost Allocation Model (see Table C-13 for sample results) disaggregates the network according to hardware and message traffic characteristics in order to produce an algorithm for charging agencies for use of the system. Factors such as the number of switches and trunks, the area switch memory capacity, the type (speed) of connectivity into the backbone, the speed and destination of messages, and the total message volume all affect the allocation of AUTODIN backbone cost. A formula using these factors breaks down the total system charges and assigns them to agencies. The formula is

$$T_i = \sum_{j=1}^{3} w_j N_j + A_1(x_i + y_i + z_i) + A_2(y_i + z_i) + A_3(z_i) + A_4 F_i$$

where

T_i = total PDC charges according to transmission unit
j = baud category
N_j = number of access lines of speed j
w_j = weighted connectivity charge of speed j

Table C-12. PROGRAM IDADIN OUTPUT: UTILIZATION AND CONNECTIVITY COSTS FOR SWITCH BY TRIBUTARY (PART 1) AND FOR PDC BY SWITCH AND TRIBUTARY (PART 2)

PART 1

TRIBUTARY	UTILIZATION	CONNECTIVITY	TOTAL
UAD018	467.60	53.73	521.32
UAD039	.37	53.73	54.09
UAD042	30.06	53.73	83.78
UAD082	613.98	53.73	667.71
UAD103	130.63	53.73	184.35
UAD110	4.39	53.73	58.12
UAD124	44.11	53.73	97.83
UAD130	360.24	53.73	413.97
UAD136	47.02	53.73	100.75
UAD137	17.42	53.73	71.15
UAD154	423.55	53.73	477.28
UAD168	.37	53.73	54.09
UAD224	499.26	53.73	552.99
UAD225	3.06	53.73	56.79
UAD226	13.99	53.73	67.72
SASC...UAD	2656.05	805.89	3461.94
UAK021	54.89	53.73	108.61
UAK040	371.46	53.73	425.19
UAK044	22.46	53.73	76.18
UAK053	181.64	53.73	235.37
UAK091	442.95	53.73	496.67
UAK224	393.47	53.73	447.20
UAK225	1.46	53.73	55.19
UAK226	24.03	53.73	77.75
SASC...UAK	1492.36	429.81	1922.17
UA0018	20.38	53.73	74.11
UA0039	858.54	53.73	912.27
UA0054	143.80	53.73	197.52
UA0060	233.51	53.73	287.24
UA0077	664.18	53.73	717.90
UA0084	.37	53.73	54.09
UA0097	1.46	53.73	55.19
UA0107	46.52	53.73	100.24
UA0109	.37	53.73	54.09
UA0224	537.71	53.73	591.44
UA0225	.73	53.73	54.46
UA0226	19.29	53.73	73.02
SASC...UAO	2526.97	644.71	3171.68
UCISVM	485.48	53.73	539.21
UCI062	348.13	53.73	401.85
UCI118	7.09	53.73	60.81
UCI195	7.24	53.73	60.98
SASC...UCI	847.95	214.90	1062.86
UCLSVM	647.96	53.73	701.68
UCL007	8.78	53.73	62.51
UCL180	10.75	53.73	64.47

(continued on next page)

Table C-12 (concluded)

PART 2

TRIBUTARY	UTILIZATION	CONNECTIVITY	TOTAL
$MDC...	52466.86	9025.94	61492.80
UWM122	3.66	53.73	57.38
$ASC...UWM	3.66	53.73	57.38
$MDC...AAAI	3.66	53.73	57.38
UAD134	56.09	53.73	109.81
$ASC...UAD	56.09	53.73	109.81
UAK088	176.24	53.73	229.96
$ASC...UAK	176.24	53.73	229.96
UAD052	7.50	53.73	61.22
UAD103	118.95	53.73	172.67
$ASC...UAD	126.44	107.45	233.89
UMH175	70.38	53.73	124.11
$ASC...UMH	70.38	53.73	124.11
UMM047	26.82	53.73	80.55
$ASC...UMM	26.82	53.73	80.55
$MDC...AAAJ	455.97	322.36	778.32
UAD079	1838.25	161.18	1999.43
UAD135	606.65	53.73	660.37
$ASC...UAD	2444.90	214.90	2659.80
UAK057	160.40	161.18	321.58
$ASC...UAK	160.40	161.18	321.58
UAD010	1427.36	53.73	1481.09
UAD106	279.20	53.73	332.93
$ASC...UAD	1706.56	107.45	1814.02
UMM076	189.61	53.73	243.34
UMM106	411.01	53.73	464.73

Table C-13. PROGRAM IDADIN OUTPUT: COST ALLOCATION MODEL SUMMARY

A U T O D I N - 1 T R A F F I C A N A L Y S I S (7 DAY SAMPLE)

IDA AUTODIN COST ALLOCATION MODEL SUMMARY
(ANNUAL BASIS)

INPUT PARAMETERS

COSTS ($/YR)

SWITCH	43944160
CONUS TRUNKS	355992
OVRSEAS TRUNKS	1781988
TOTAL	46082140
ADU MEMORY	8788832
(ALPHA)	(.20)

TECHNICAL FACTORS

AREA MEMORY CAPACITY	21060
AREA TRUNK TERMINATIONS	56
INTER-AREA TERMINATIONS	17

USAGE COST FACTORS

LINE BLOCKS	1.000
MESSAGES	0.000
FLASH WEIGHTS	0.000

SURCHARGES ($/UNIT)

	LOCAL	AREA	INTER
ALL	.10	.15	.30
FLASH	0.00	0.00	0.00

SAMPLE CHARACTERISTICS

DAYS OF TRAFFIC: 7

NUMBER OF CONNECTIONS

SLOW	MED	HIGH	TOTAL
893	315	114	1322

VOLUME OF TRAFFIC

LBLKS	MSGS	LBLK/MSG
78319983	1963261	39

TYPE OF TRAFFIC

	LOCAL	AREA	INTER-AREA
LBLKS	20421427	16646368	41452188
MSGS	561475	492623	909863

VOLUME OF FLASH TRAFFIC

LBLKS	MSGS	LBLK/MSG
115162	9251	12

RATE ANALYSIS

COST ALLOCATION ($/YR)

UTILIZATION	38146317
CONNECTIVITY	7935823
TOTAL	46082140

ACCESS CHARGES ($/MO)

BASE CHARGE	43.01
SLOW SPEED	279.04
MED SPEED	837.11
HIGH SPEED	1302.17

UTILIZATION RATES ($/UNIT)

	LOCAL	AREA	INTER AREA
LBLKS	.0035	.0038	.0047
MESSAGES	.1000	.1500	.3000
WEIGHTS	1.0000	1.0000	1.0000

BACKBONE CHARGES BY AGENCY

AGENCY	AGENCY CHARGES UTILZATN	CONNEC	TOTAL	PERCENT BREAKDOWN (WITHIN AGENCY) UTILZATN	CONNEC	CHARGES AS PERCENT OF TOTAL UTILZATN	CONNEC	TOTAL
D	1601263	562539	2163803	.74	.26	4.20	7.09	4.70
A	9952754	2417580	12370334	.80	.20	26.09	30.46	26.84
B	4584868	1338263	5923131	.77	.23	12.02	16.86	12.85
C	9084719	1637927	10722646	.85	.15	23.83	20.58	23.27
E	412359	92640	504999	.82	.18	1.08	1.17	1.10
F	42488	123893	166381	.26	.74	.11	1.56	.36
G	7116152	412975	7529128	.95	.05	18.65	5.20	16.34
M	9219	10045	15264	.34	.66	.01	.13	.03
N	1265	10045	11311	.11	.89	.00	.13	.02
P	329493	220998	547491	.60	.40	.86	2.78	1.19
W	11842	13394	25236	.47	.53	.03	.17	.05
X	524476	100453	624930	.84	.16	1.37	1.27	1.36
Z	4477417	1000070	5477487	.82	.18	11.74	12.60	11.89
TOTAL	38146317	7935823	46082140	.83	.17	100.00	100.00	100.00

A = utilization rate charged for message traffic

i = transmission unit, either line blocks or messages

x_i = volume of 'LOCAL' transmission units

y_i = volume of 'AREA' transmission units

z_i = volume of 'INTER-AREA' transmission units

F_i = volume of 'FLASH' transmission units.

In order to use this allocation formula several steps are followed. First, input parameters for the network are identified. These include total costs of the system, apportioned into percentages for switches and trunks, switch memory ratios (area and inter-area trunk terminations divided by line blocks passing through the switch), and arbitrary weights and surcharges for segmenting message traffic in a utilization pricing structure. Next, message traffic of the particular sample is examined in terms of geographical destination (local, area, or inter-area), and total traffic is broken down into separate line blocks and message counts. FLASH traffic, given top priority in transmission, is treated as a subcategory with the same breakdown so that both weights and surcharges can be assessed. In addition, the number of access lines is accumulated consistently with three groupings for transmission speeds (75-300 baud, 600-1200 baud, and 2400-4800 baud).

Third, PDC charges are set to be allocated using the connectivity/utilization ratio deemed optimal. Rates for connectivity typically have a standard connection charge for access to the network and a progressive rate scaled for the three transmission speed categories. Depending on the transmission unit used for message traffic--line blocks or messages--utilization rates are prorated according to precedence (FLASH or regular traffic) and geographical destination. Finally, total backbone charges are accumulated for each agency with subtotals for utilization and connectivity.

4. The IDADIN Subprograms

The 16 IDADIN subprograms fall into three general categories: procedural, functional, and output.

a. The Procedural Subprograms. Subroutine CNNCT produces a breakdown of total ADU memory utilization by switch (Table C-9). Subroutine ATA performs the agency traffic analysis, aggregating by the first letter of the program designator code, and produces the formatted printed output report shown in Appendix B. Subroutine PRTATA is called by ATA to print the final summary table for the traffic analysis (Table C-10). Subroutine CHARGE computes the cost allocation to any charging point (tributary) using the cost allocation model outlined earlier. Arguments to the procedure supply information on the volume of traffic generated by the charging point and the parameters of the cost allocation model itself. Subroutine OUTPUT produces the formatted printed output report of the results of the cost allocation model (Table C-13) and Subroutine TAB prints out the results by program designator code.

b. The Functional Subprograms. Subroutine PCT is called by Subroutine ATA to compute percentages of the agency total, system total in that class, and the overall system total (Table C-10). Integer Function MATCH performs an integer linear search when called. Integer Function SPDCLS returns as its function value the integer one, two, or three corresponding to the class of speed to which the argument belongs. Real Function TOTAL returns as its function value the sum of the values of its real argument array and Integer Function SUM returns as its function value the sum of its integer argument array. Subroutine CLEAR is used to zero an area of memory.

c. The Output Routines. Subroutine SAMPLE computes and places into common block PCA an alphanumeric representation of the numbers of days in the traffic sample. Subroutine TITLE

prints the heading line on each page of printed output, sequentially numbering all pages starting with Page 1. It also prints the number of days in the sample using results supplied by Subroutine SAMPLE. Subroutine CENTER produces a line of printed output in which the argument to the subroutine is printed in the middle of the output page. Subroutine PAGE is used to control pagination and spacing in the output reports.

E. PROGRAM LISTING FOR DNCOSTCD

```
---- ***** UNCLASSIFIED *****          03/30/77          PAGE NO. 000002

C                    THE REVISED DNCOSTCD
      PROGRAM DNCOSTCD(INPUT,OUTPUT,TAPE1,TAPE2,TAPE3,TAPE5=INPUT)
C     TAPE1=AMIE, TAPE2=SORTTAPE, TAPE3=STASUB (OUTPUT)
      INTEGER SWITCH(17),GAC(17),I,J,K,KSWTCH,AMIE(4),W(7),
     1T(18),L(4,3),BLANK,Z,TRIB(2),ZZZ,LINE,READ,NNN,L1,L2,L3,L4
      LOGICAL EIF
      COMMON/GEOG/KSWTCH,SWITCH,GAC
      DATA BLANK/6H      /,L/6,9,13,16,7,10,14,17,8,11,15,18/,Z/1HZ/,
     1THIH/0.0/,ZZZ/3HZZZ/,EIF/.FALSE./,LINE/60/
      I=0
   10 READ(5,1000)J,K
      IF(EOF(5))40,20
   20 I=I+1
      IF(I.LE.17)GO TO 30
      PRINT 1010
      STOP
   30 SWITCH(I)=J
      GAC(I)=K
      GO TO 10
   40 KSWTCH=I
      CALL SORT(KSWTCH,SWITCH,GAC)
      PRINT 1070,(SWITCH(I),GAC(I),I=1,KSWTCH)
      READ(1,1020)AMIE
      READ=1
      CALL TRACK(1)
      PRINT 1080
      GO TO (50,90,125,140),READ
   50 READ=1
      READ(2,1030)W
   60 K=1
      IF(W(3).EQ.W(5))GO TO 70
      K=2
      IF(LOC(W(3)).NE.LOC(W(5)))K=3
   70 T(1)=W(3)
      T(2)=W(4)
      T(3)=W(7)
      T(4)=BLANK
      T(8)=BLANK
      DO 80 I=6,18
   80 T(I)=0
      L1=L(1,K)
      L2=L(2,K)
      L3=L(3,K)
      L4=L(4,K)
      T(L1)=W(6)
      T(12)=1
      T(L3)=1
      IF(W(2).NE.4)GO TO 90
      T(L2)=W(6)
      T(L4)=1
   90 IF(AMIE(2).EQ.BLANK)GO TO 125
      IF(T(1).LE.AMIE(1))GO TO 110
   95 READ=2
      READ(1,1020)AMIE
      IF(EOF(1))100,90
  100 AMIE(1)=ZZZ
      AMIE(2)=NNN

---- ***** UNCLASSIFIED *****          03/30/77          PAGE NO. 000002
```

```
      GO TO 140
  110 IF(T(1).LT.AMIE(1))GO TO 140
  120 IF(T(2).LE.AMIE(2))GO TO 130
  125 READ=3
      READ(1,1020)AMIE
      IF(EOF(1))170,90
  130 IF(T(2).LT.AMIE(2))GO TO 140
      T(4)=AMIE(3)
      T(5)=AMIE(4)
  140 READ=4
      READ(2,1030)W
      IF(EOF(2))170,150
  150 IF(W(3).NE.T(1).OR.W(4).NE.T(2))GO TO 180
      K=1
      IF(W(3).EQ.W(5))GO TO 160
      K=2
      IF(LOC(W(3)).EQ.LOC(W(5)))K=3
  160 L1=L(1,K)
      L2=L(2,K)
      L3=L(3,K)
      L4=L(4,K)
      T(L1)=T(L1)*W(6)
      T(L3)=T(L3)*1
      T(L2)=T(L2)*1
      IF(W(2).NE.4)GO TO 140
      T(L2)=T(L2)*W(6)
      T(L4)=T(L4)*1
      GO TO 140
  170 EIF=.TRUE.
  180 LINE=LINE+1
      IF(LINE.LE.50)GO TO 190
      LINE=1
      PRINT 1040
  190 PRINT 1050,1
      WRITE(3,1040)T
      IF(.NOT.EIF)GO TO 60
      STOP
  100 FORMAT(A3,A1)
  101 FORMAT(*1TOO MANY SWITCH CODES.*)
  102 FORMAT(2A3,2A4)
  103 FORMAT(A3,A1,3A3,I3,A6)
  104 FORMAT(1H1)
  105 FORMAT(1X,2A3,2X,A6,2X,A4,2X,A4,2X,A4,I3I8)
  106 FORMAT(A3,A3,A6,2A4,3I9,3I6,7X,I8,6I9)
  107 FORMAT(*1SWITCH DESIGNATIONS ARE */(/5X,A3,5X,A1))
  108 FORMAT(*-RETURN FROM INPUT ERROR.*)
      END
```

```
**** UNCLASSIFIED ****        03/30/77        PAGE NO. 000005

      SUBROUTINE SORT(K,N,T)
      INTEGER I,J,P,Q,H,N(1),T(1)
      Q=K-1
      DO 2A I=1,Q
      P=I+1
      IF(P.GT.K)GO TO 2A
      DO 1A J=P,K
      IF(N(J).GE.N(I))GO TO 1A
      H=N(I)
      N(I)=N(J)
      N(J)=H
      H=T(I)
      T(I)=T(J)
      T(J)=H
 1A   CONTINUE
 2A   CONTINUE
      RETURN
      END
```

```
**** UNCLASSIFIED ****        03/30/77        PAGE NO. 000007

      INTEGER FUNCTION LOC(Y)
      INTEGER I,J,K,T,N,S,CODE,P
      COMMON N/GEN/N,S(17),CODE(17)
      J=(N+1)/2
      I=1
      K=N
      DO 3A P=1,N
      IF(T.EQ.S(J))GO TO 4A
      IF(T.LT.S(J))GO TO 1A
      I=J+1
      GO TO 2A
 1A   K=J-1
 2A   IF(I.LE.0.AND.K.GT.N)GO TO 4A
      J=(I+K)/2
 3A   CONTINUE
 4A   WRITE(108,100)T
      LOC=0
      RETURN
 5A   LOC=CODE(J)
      RETURN
100A  FORMAT(' SWITCH NOT FOUND---',A3)
      END
```

F. PROGRAM LISTING FOR IDADIN

```
      PROGRAM IDADIN(INPUT,OUTPUT,TAPE1,TAPE5=INPUT)

C-----------------------------------------------------------------------
C    THIS PROGRAM IS THE IDA FORTRAN VERSION OF THE DEFENSE
C    COMMUNICATIONS AGENCY PL1 COMPUTER PROGRAM UNCOSTRP
C    (THE AUTODIN COST ALLOCATION MODEL).  PL1/FORTRAN
C    CONVERSION AND PROGRAMMING MODIFICATIONS BY RADUCHEL,
C    FRY, KIERNAN, AND DAVIDSON, MARCH 1977.
C-----------------------------------------------------------------------

      COMMON/IP/RIP1,RIP2,RIP3,RIP4,RIP5,RIP6,RIP7,RIP8,RIP9,RIP10,
     X    RIP11,RIP12,RIP13
      COMMON/SC/LBLOCAL,LBAREA,LBIA,LBVOL,LBMS,
     X   MSLOCAL,MSAREA,MSIA,MSVOL,
     X  FLBVOL,FMSVOL,FLBMS,
     $  NCNSLOW,NCNMED,NCNHI,ICONS
      COMMON/RA/RA1,RA2,RA3,RA4,RA5,RA6,RA7,RA8,RA9,RA10,RA11,RA12,RA13

      DIMENSION LBPUC(150),MSPUC(150),NCNPUC(150)

      INTEGER W(10),TOTAL(15),PUC(15,150),CODES(150),KCODES,I,J,K,L(12),
     $L1,L2,ID(5),SPDBLK(3),LOC,LINE,AGENCY,SPUCLS,TOT(15),CONN(3,9),
     $SWITCH(9),FLBVOL,FMSVOL,FLBMS,SUM,IOPT
      REAL S,COST,MCOST,TRIC,TROC,TRKC,TRKI,LBLKS,USE(3,2),CON(3),ACHG(3
     $),X(6),T(3),FLASH,X1,X2,PDCCST(3,150),PCNT(3),CHG(3,3),BLOCKS,
     $MSGCHG(6),MSGWTS(3),SMARK(2),X3
      REAL PCNTOP(3),ACHGOP(3)

      LOGICAL BRKDWN,PRTTA
      DATA BRKDWN/.FALSE./,BLOCKS/0.0/,FLASH/0.0/,SPDBLK/3,9,14/,MSGCHG/
     $6*0.0/,LBALC/0.0/,MSGWTS/3*1.0/,PRTTA/.TRUE./
      DATA L/6,7,8,9,10,11,13,14,15,16,17,18/
      DATA SWITCH/3HUEB,3HUEU,3HUEO,3HUCI,3HUCL,3HUWJ,3HUWM,3HUWT,3HUHH/
      COMMON/PCA/IOPT,DAYS
      NAMELIST/LIST/S,MCOST,TRIC,TROC,TRKC,TRKI,LBLKS,BRKDWN,
     $SPDBLK,FLASH,BLOCKS,MSGCHG,MSGWTS,PRTTA
      IOPT=7
C     INPUT COST BASIS

C READ OPTION CARD
      READ(5,LIST)
      CALL SAMPLE
C     NOW, PRINT THEM OUT FORMATTED
      CALL CLEAR(225,PUC)
      CALL CLEAR(27,CONN)

C     READ IN FIRST DATA RECORD & SETUP LOOP
      READ(1,1010)W
      KCODES=1
      CODES(1)=W(4)
      K=1
      L1=1
      DO 20 I=1,3
      J=12*I
      TOTAL(J)=0
      PUC(J,1)=0
```

```
      DO 2[illegible] C=1,4
      L1=-1*I
      L2=L(L1)
      TOTAL(L1)=W(L2)
   20 PUC(L1,I)=W(L2)
      I=SPUCLS(W(5))+1
      TOTAL(I)=1
      PUC(I,I)=1
      ID(1)=W(1)
      ID(2)=W(2)
      I=I+12
      J=MATCH(W(1),4,SWITCH)
      IF(J.GT.0)CONN(I,J)=1
C     BEGIN BASIC LOOP
   30 READ(1,101)W
      IF(EOF(1))40,4
   40 DO 50 K=1,KCODES
      IF(W(4).EQ.CODES(K))GO TO 60
   50 CONTINUE
      KCODES=MIN0(15,KCODES+1)
      CODES(KCODES)=W(4)
      K=KCODES
   60 DO 70 L1=1,12
      L2=L(L1)
      TOTAL(L1)=TOTAL(L1)+W(L2)
   70 PUC(L1,K)=PUC(L1,K)+W(L2)
      IF(W(1).EQ.ID(1).AND.W(2).EQ.ID(2))GO TO 30
      ID(1)=W(1)
      ID(2)=W(2)
      I=SPUCLS(W(5))+12
      TOTAL(I)=TOTAL(I)+1
      PUC(I,K)=PUC(I,K)+1
      J = MATCH(W(1),4,SWITCH)
      I=I-12
      IF(J.GT.0)CONN(I,J) = CONN(I,J)+1
      GO TO 30
C     END OF BASIC LOOP/COMPUTE COST FACTORS
   80 IF(.NOT.PRT1A)GO TO 85
      CALL CONCT(4,SWITCH,CONN)
      CALL APA(KCODES,CODES,PUC)
C     BEGIN BASIC RECHARGING LOOP
C
   85 CALL CLEAR(3,ACMOUP)
      CALL CLEAR(3,PCNTOP)
      RIP1 = SWCOST*52.
      RIP2 = MCOST*52.
      RIP3 = TRIC*52.
      RIP4 = TRUC*52.
      RIP5 = RIP1 + RIP3 + RIP4
      RIP6 = LABOR
      RIP7 = TRKC
      RIP8 = TRKI
      L1=
      L2=3
      L1=
      L2=3
      K=
      DO 100 I=1,2
```

```
      DO 90 I=1,3
      K=K+1
      L1=L1+1
      L2=L2+1
   90 X(K)=FLOAT(TOTAL(L1))*FLASH*FLOAT(TOTAL(L2))
      L1=L1+3
  100 L2=L2+3
      L1=5
      L2=5
      T(1)=0.
      T(2)=0.
      DO 110 I=1,3
      L1=L1+1
      L2=L2+1
      T(1) = T(1)+MSGCHG(L1-6)*FLOAT(TOTAL(L1))
  110 T(2) = T(2)+MSGCHG(L2-6)*FLOAT(TOTAL(L2))
      T(3)=SYSCOST-MCOST-T(1)-T(2)
C     COMPUTE MEMORY RATIOS
      X1=28.0*TRKC/LMEMS
      X2=28.0*TRKI/LMEMS
C     COMPUTE UTILIZATION PRICES
      J=1
      DO 120 I=1,2
      X3=1.0/(MSGWTS(1)*X(J)+MSGWTS(2)*X(J+1)+MSGWTS(3)*X(J+2))
      USE(1,I)=MSGWTS(I)*X3
      USE(2,I)=(TRUC+X1*MCOST)/(X(J+1)+X(J+2))
      USE(3,I)=USE(2,I)+(TRUC+X2*MCOST)/X(J+2)+MSGWTS(3)*A3
      USE(2,I)=USE(2,I)+X3*MSGWTS(2)
  120 J=J+3
      SHARE(1)=AMAX1(0.0,AMIN1(1.0,BLOCKS))
      SHARE(2)=1.0-SHARE(1)
      RIP9  = SHARE(1)
      RIP10 = SHARE(2)
      DO 130 I=1,2
      DO 130 J=1,3
  130 USE(J,I)=USE(J,I)*SHARE(I)
C     COMPUTE STANDARD CONNECT RATE THEN BY SPEED
      A1=(1.0-X1-X2)*MCOST
      K=TOTAL(13)*SPOBLK(1)+TOTAL(14)*SPOBLK(2)+TOTAL(15)*SPOBLK(3)
      X2=1./FLOAT(K)
      DO 140 I=1,3
      CON(I)=X2*FLOAT(SPOBLK(I))
  140 T(I)=4.33333*CON(I)
      X2=4.33333*X2
C     PRINT OUT COSTS BY PDC
      RIP11 = FLASH
      RIP12 = MSGCHG(1)
      RIP13 = MSGCHG(1)
      RA4 = X2
      RA5 = T(1)
      RA6 = T(2)
      RA7 = T(3)
      RA8 = USE(1,1)
      RA9 = USE(2,1)
      RA10 = USE(3,1)
      RA11 = USE(1,2)+MSGCHG(1)
      RA12=MSGCHG(2)+USE(2,2)
      RA13=USE(3,2)+MSGCHG(3)
```

```
      CALL CHARGE(TOTAL,USE,CON,FLASH,MSGCHG,1)
      RA1 = T(1)*52.
      RA2 = T(2)*52.
      RA3 = T(3)*52.
      LINES=0
C LINE BLOCKS
      LBLOCAL = SUM(RCODES,PDC(1,1),15)
      LBAREA = SUM(RCODES,PDC(2,1),15)
      LBIA = SUM(RCODES,PDC(3,1),15)
      LBVOL = LBLOCAL + LBAREA + LBIA
C MESSAGES
      MSLOCAL = SUM(RCODES,PDC(7,1),15)
      MSAREA = SUM(RCODES,PDC(8,1),15)
      MSIA = SUM(RCODES,PDC(9,1),15)
      MSVOL = MSLOCAL + MSAREA + MSIA
      LBMS = LBVOL/MSVOL
C CONNECTIONS
      NCNSLOC = SUM(RCODES,PDC(13,1),15)
      NCNMED = SUM(RCODES,PDC(14,1),15)
      NCNMI = SUM(RCODES,PDC(15,1),15)
      NCONS = NCNSLOC + NCNMED + NCNMI
C FLASH LINE BLOCKS
      FLBVOL = 0
      DO 300 J=4,6
  300 FLBVOL = FLBVOL + SUM(RCODES,PDC(J,1),15)
C FLASH MESSAGES
      FMSVOL = 0
      DO 301 J=10,12
  301 FMSVOL = FMSVOL+SUM(RCODES,PDC(J,1),15)
      FLRATE = FLBVOL/FMSVOL
      DO 150 I=1,RCODES
  150 CALL CHARGE(PDC(I,1),USE,CON,FLASH,MSGCHG,PDCCST(I,1))
      CALL TAB(RCODES,CODES,PDCCST)
      CALL OUTPUT(MSGCHG,MSGWTS)
C     PRINT OUT COSTS BY AGENCY
      DECODE(1,170,CODES(1))AGENCY
      DO 160 I=1,3
  160 ACHG(I)=PDCCST(I,1)
      K=1
  170 K=K+1
      DECODE(1,170,CODES(K))J
      IF(AGENCY.NE.J)GO TO 190
      DO 180 I=1,3
  180 ACHG(I) = ACHG(I)+PDCCST(I,K)
      IF(K.LT.RCODES)GO TO 170
  190 DO 200 I=1,3
      PCNT(I) = (100.0*ACHG(I)/T(I))
      PCNTOP(I) = PCNTOP(I)+PCNT(I)
      ACHG(I) = ACHG(I)*52.
      ACHGOP(I) = ACHGOP(I) + ACHG(I)
  200 CONTINUE
      X1=ACHG(1)/ACHG(3)
      X2=ACHG(2)/ACHG(3)
      IF(AGENCY.EQ.IMD) AGENCY = IMD
      PRINT 1200,AGENCY,ACHG,X1,X2,PCNT
      DO 210 I=1,3
  210 ACHG(I)=PDCCST(I,K)
      AGENCY=J
```

```
      IF(A.LT.KCODES)GO TO 170
      DO 220 I=1,3
      PCNT(I) = (100.0*ACHG(I)/T(I))
      PCNTOP(I) = PCNTOP(I)+PCNT(I)
      ACHG(I) = ACHG(I)*52.
      ACHGOP(I) = ACHGOP(I) + ACHG(I)
  220 CONTINUE
      X1=ACHG(1)/ACHG(3)
      X2=ACHG(2)/ACHG(3)
      PRINT 1000,AGENCY,ACHG,X1,X2,PCNT
      X1TOT = ACHGOP(1)/ACHGOP(3)
      X2TOT = ACHGOP(2)/ACHGOP(3)
      PRINT 1005,ACHGOP,X1TOT,X2TOT,PCNTOP
C     CHECK IF BREAKDOWN REQUESTED
      IF(.NOT.BRKDWN)GO TO 350
C     PRINT OUT BREAKDOWN
      DO 230 I=1,3
      TOT(I+12)=0
      DO 230 J=1,3
  230 CHG(J,I)=0
      LINE=0
      NEWIN=1
      READ(1,1010)W
  240 DO 250 I=1,5
  250 ID(I)=W(I)
      DO 260 L1=1,12
      L2=L(L1)
  260 TOT(L1)=W(L2)
C     BEGIN LOOP FOR TRIBUTARY
  270 READ(1,1010)W
      IF(EOF(1))340,280
  280 IF(W(1).NE.ID(1).OR.W(2).NE.ID(2))GO TO 300
      DO 290 L1=1,12
      L2=L(L1)
  290 TOT(L1)=TOT(L1)+W(L2)
      GO TO 270
  300 K=12+SPOCLS(ID(5))
      TOT(K)=1
      CALL CHARGE(TOT,USE,CON,FLASH,MSGCHG,CHG)
      TOT(K)=0
      CALL PAGE(LINE,1)
      PRINT 1110,ID(1),ID(2),(CHG(I,1),I=1,3)
      DO 310 I=1,3
  310 CHG(I,2)=CHG(I,2)+CHG(I,1)
      IF(W(1).EQ.ID(1))GO TO 240
      CALL PAGE(LINE,2)
      PRINT 1120,ID(1),(CHG(I,2),I=1,3)
      DO 320 I=1,3
      CHG(I,3)=CHG(I,3)+CHG(I,2)
  320 CHG(I,2)=0
      IF(W(1).EQ.ID(4))GO TO 240
      CALL PAGE(LINE,3)
      PRINT 1130,ID(4),(CHG(I,3),I=1,3)
      DO 330 I=1,3
  330 CHG(I,3)=0
      GO TO 240
  340 CALL PAGE(LINE,2)
      PRINT 1120,ID(1),(CHG(I,2),I=1,3)
```

```
      CALL PAGE(LINE,3)
      PRINT 11,(ID(I),I=1,3),(CHG(I),I=1,3)
  350 READ(5,LIST)
      IF(-OF(5))STOP
      GO TO -5
 1000 FORMAT(3X,A1,3X,3(1X,F9.6),2X,2(5X,F3.2),4X,2(4X,F5.2),2X,F5.2)
  600 FORMAT(8I10)
 1005 FORMAT(/2X,*10(AL*,3F10.6,2X,2(5X,F3.2),6X,F7.2,F9.2,F7.2)
 1010 FORMAT(2A3,A6,A4,14,3I9,3I6,7X,I8,6I9)
 1040 FORMAT(A1)
 1100 FORMAT(*0*,3X,A1,7X,3F15.2,10X,3F15.2,10X,2F5.2)
 1110 FORMAT(3X,2A3,11A,3F15.2)
 1120 FORMAT(*0$ASC...*,A3,9X,3F15.2//)
 1130 FORMAT(*0$DUC...*,A4,8X,3F15.2//)
      END
```

```
      SUBROUTINE SAMPLE
      INTEGER A,BLANK,I,K,LP,S,T(4)
      DATA BLANK/1H /,LP/1H(/
      COMMON/PCA/K,A
      ENCODE(4,1000,S)K
      DECODE(4,1010,S)T
      DO 10 I=2,4
   10 IF(T(I).NE.BLANK) GO TO 20
   20 T(I-1) = LP
      ENCODE(4,1010,S)T
      RETURN
 1000 FORMAT(I4)
 1010 FORMAT(4A1)
      END
```

```
      SUBROUTINE CANC(K,S,N)
      INTEGER K,S(1),N(3,1),TOTAL,USE(3),J,L
      DATA USE/6,16,26/,TOTAL/1170/
      PRINT 1000
      DO 20 I=1,K
      L = 0
      DO 10 J=1,3
   10 L = L+USE(J)*N(J,I)
      L = (100*L+TOTAL-1)/TOTAL
   20 PRINT 1010,S(I),(N(J,I),J=1,3),L
      RETURN
 1000 FORMAT(*1*,10X,*ADD MEMORY UTILIZATION BY SWITCH*/* SWITCH*,11X,
     $*SLOW*,9X,*MEDIUM*,11X,*HIGH*,8X,*PERCENT*///)
 1010 FORMAT(1H ,3X,A6,3I15)
      END
```

```
      SUBROUTINE ATA(N,L,P)
      INTEGER I,J,K,L,P,N,KDAYS,LINE,SUM,AGENCY(25),C(1),D(2,)
     $M1(4,3),M2(4,4),LIT(3),B(3,5,1),T(3,5,25)
      REAL X(4,5,25),R,S,D(8,25,4),W
      COMMON/PCA/KDAYS
      DATA LIT/1HD,1H*,1H*/
      DATA M1/10H*L I N E  ,10H B L O C K,3H S*,1H ,10HLINE BLOCK,
     $10HS PER MESS,3HAGE,1H ,10H*M E S S A G E S*,1H ,1H /
      DATA M2/6HTOTALS,3*1H ,10HAS PERCENT,10H OF AGENCY,10H TRAFFIC B,
     $10HY CLASS   ,10HAS PERCENT,10H OF SYSTEM,10H TRAFFIC B,
     $10HY CLASS   ,10HAS PERCENT,10H OF TOTAL ,10HSYSTEM TRAFFIC/
      EQUIVALENCE (AGENCY(1),D(1))
      L=1
      M=0
      CALL CLEAR(375,1)
      LINE=LIT(2)
10    DECODE(1,1000,C(L))K
      IF(K.EQ.LINE)GO TO 20
      M=M+1
      AGENCY(M)=K
      LINE=K
20    DO 30 J=1,5
      DO 30 I=1,3
30    T(I,J,M)=T(I,J,M)+P(I,J,L)
      L=L+1
      IF(L.LE.N)GO TO 10
      DO 50 K=1,M
      DO 50 J=1,5
      S=0
      DO 40 I=1,3
      R=FLOAT(T(I,J,K))
      S=S+R
40    X(I,J,K)=R
50    X(4,J,K)=S
      L=M+1
      DO 60 J=1,5
      DO 60 I=1,4
60    X(I,J,L)=TOTAL(X(I,J,1),20)
      CALL PCT(X(1,5,1),20,0,8,25)
      AGENCY(L)=LIT(1)
      AGENCY(L)=LIT(3)
      CALL TITLE
      PRINT 1020
      DO 70 K=1,L
70    PRINT 1030,AGENCY(K),(X(I,5,K),(D(I,K,J),J=1,3),I=1,4)
      DO 90 K=1,3,2
      DO 80 J=1,L
      DO 80 I=1,4
      D(I,J,1)=X(I,K,J)
80    D(I,4,J,1)=X(I,K+1,J)
      CALL PCT(L,D,8,W(1,1,2),8,25)
      CALL PCT(L,W(5,1,1),8,W(5,1,2),8,25)
      DO 90 J=1,4
      CALL TITLE
      CALL CENTER(40,M1(1,K))
      CALL CENTER(40,M2(1,J))
90    CALL PRTATA(L,AGENCY,W(1,1,J))
```

```
      CALL TITLE
      CALL CENTER(4H  ,M1(1,2))
      DO 100 J=1,L
      DO 100 I=1,4
      S=X(I,3,J)
      R=0.0
      IF(S.GT.0.0)R=X(I,1,J)/S
      Q(I,J,1)=R
      S=X(I,4,J)
      R=0.0
      IF(S.GT.0.0)R=X(I,2,J)/S
  100 Q(I,4,J,1)=R
      CALL HEADA(L,AGENCY,0)
      LINE=4
      DO 150 M=1,L
      K=0
      DO 120 J=1,4
      L=0
      DO 110 I=1,3
      K=K+1
      D(K)=P(I,J,M)
  110 L=L+D(K)
      K=K+1
  120 D(K)=L
      DO 130 I=1,4
      L=D(I,4)
      J=0
      IF(L.NE.0)J=(D(I)*L/2)/L
      K=K+1
  130 D(K)=J
      L=0
      DO 140 I=1,3
      K=K+1
      D(K)=P(I,5,M)
  140 L=L+D(K)
      D(24)=1
      LINE=LINE+4
      IF(LINE.LE.40)GO TO 150
      LINE=4
      CALL TITLE
      PRINT 1040
  150 PRINT 1050,(D(M),M=1,24)
      RETURN
 1000 FORMAT(A1)
 1020 FORMAT(*-*,45X,*S Y S T E M  A C C E S S  A N A L Y S I S*///
     $*0AGENCY*/1H0,1X,A4,*S L O W*,24X,*M E D I U M*,23X,*H I G H*,24X,
     $*A C C E S S*/5X,4(* NUMBER  AGENCY  SYSTEM  TOTAL*) /5X,4(8X,* PERCEN
     $T PERCENT PERCENT*)///)
 1030 FORMAT(1H0,1X,A4,1X,4(2X,(F4.0,3F8.2)))
 1040 FORMAT(1H-,20X,36H*H E G U L A R  I N A F F I C*,17X,26H*F L A S H
     $  T R A F F I C*/8H PROGRAM,3X,2(19X,12HLINE  BLOCKS,14X),11X,
     $13H*CONNECTIONS*/11H DESIGNATION,2(21X,6HMESSAGES,11X)/5H CODE,
     $6X,2(13X,23HLINE BLOCKS PER MESSAGE,9X),8X,25HCLOSE MEDIUM CODE  HIGH
     $  ACC/11X,2(10X,5HLOCAL,6X,4HAREA,5X,5HINTER,7X,3HALL))
 1050 FORMAT(1H0,A4,*  *,2(5X,4I10),2(/11X,5X,4I10,5X,4I10),4X,4I7)
      END
```

```
      SUBROUTINE PRTAIR(N,C,X)
      INTEGER I,J,K,N,C(1)
      REAL X(4,2,1)
      PRINT 1000
      DO 10 I=1,N
   10 PRINT 1010,C(I),((X(J,K,I),J=1,4),K=1,2)
      RETURN
 1000 FORMAT('_AGENCY',17X,30H*R E G U L A R  T R A F F I C*,36X,20H*F I
     $ A S H  T R A F F I C*/5X,2(14X,*LOCAL*,11X,*AREA*,5X,
     $*INTER-AREA*,12X,*ALL*)//)
 1010 FORMAT(1HO,3X,A1,8(4X,4F15.2))
      END
```

```
      SUBROUTINE PCT(N,A,MK,P,MR,MR2)
      INTEGER I,J,N,MK,MR,MR2
      REAL A(MR,1),P(MR2,MK+1),R,S,W
      R=0.0
      IF(A(4,N).NE.0.0)R=100.0/A(4,N)
      DO 10 J=1,MK
      S=0.0
      IF(A(4,J).NE.0.0)S=100.0/A(4,J)
      DO 10 I=1,4
      W=A(I,J)
      P(I,J,1)=S*W
      I=0
      IF(A(I,N).NE.0.0)I=W*100.0/A(I,N)
      P(I,J,2)=I
   10 P(I,J,3)=R*W
      RETURN
      END
```

```
      SUBROUTINE CHARGE(N,USE,CON,F,G,C)
      REAL      X(15),USE(3,2),CON(3),F,G(6),C(3)
      INTEGER I,N(15)
      DO 10 I=1,15
   10 X(I)=N(I)
      C(1)=0
      C(2)=0
      DO 20 I=1,3
      C(1)=C(1)+G(I)*X(I+6)+G(I+3)*X(9+I)+USE(I,1)*(X(1)+F*X(I+3))+
     *USE(I,2)*(X(I+6)+F*X(I+9))
   20 C(2)=C(2)+CON(I)*X(I+12)
      C(3)=C(1)+C(2)
      RETURN
      END
```

```
      SUBROUTINE TAB(N,P,C)
      INTEGER I,J,K,L,P,N,N1,N2,N3
      REAL P(1),C(3,1)
      COMMON/PCA/IOPT
      INTEGER H(5)
      DATA H/1HA,1HB,1HC,1HD,1H /,10HCOSTS BY P,1HROGRAM DES,1HIGNATOR CO,
     $2HDE/
      CALL TITLE
      CALL CENTER(5,H)
      PRINT 1000
      K=N/3
      N1=1
      N2=(N+2)/3+1
      N3=2*K
      IF(MOD(N,3).EQ.2)N3=N3+1
      DO 10 I=1,K
      PRINT 1010,P(I),(C(I,N1),I=1,3),P(N2),(C(I,N2),I=1,3),P(N3),
     $(C(I,N3),I=1,3)
      N1=N1+1
      N2=N2+1
   10 N3=N3+1
      IF(MOD(N,3).EQ.N+1)RETURN
      K=K+1
      PRINT 1010,(P(I),(C(J,I),J=1,3),I=N1,K,N2)
      RETURN
 1000 FORMAT(1H0,3(8H  DUT ILIZATION CONNECTIVITY  TOTAL  )//)
 1010 FORMAT(1X,3(A4,F10.0,F13.0,F12.0,3X))
      END
```

```
      SUBROUTINE OUTPUT(MSGCHG,MSGWTS)
      REAL MSGCHG(6),MSGWTS(3)
      INTEGER I,FLHVOL,FMSVOL,FLHMS
      COMMON/IP/RIP1,RIP2,RIP3,RIP4,RIP5,RIP6,RIP7,RIP8,RIP9,RIP10,
     X    RIP11,RIP12,RIP13
      COMMON/SC/LHLOCAL,LHAREA,LHIA,LHVOL,LHMS,
     X   MSLOCAL,MSAREA,MSIA,MSVOL,
     X  FLHVOL,FMSVOL,FLHMS,
     $  NCNSLOW,NCNMED,NCNHI,ICONS
      COMMON/PCA/IOPT
      COMMON/RA/RA1,RA2,RA3,RA4,RA5,RA6,RA7,RA8,RA9,RA10,RA11,RA12,RA13
C THIS IS THE INPUT SECTION
      CALL TITLE
      PRINT 3
      PRINT 1
      PRINT 4
      PRINT 5
      PRINT 6,RIP1, RIP9
      PRINT 7,RIP3, RIP6, RIP10
      PRINT 8,RIP4, RIP11
      PRINT 9,      RIP7
      PRINT 10,RIP5
      PRINT 11,     RIP8
      PRINT 12,(MSGCHG(I),I=1,3)
      PRINT 13,RIP2,(MSGCHG(I),I=4,6)
C THIS IS THE SAMPLE CHARACTERISTICS SECTION
      PRINT 15
      PRINT 16
      PRINT 17,IOPT
      PRINT 18,NCNSLOW,NCNMED,NCNHI,ICONS, LHVOL,MSVOL,LHMS
      PRINT 19
      PRINT 21
      PRINT 22,LHLOCAL,LBAREA,LBIA,  FLBVOL,FMSVOL,FLBMS
      PRINT 23,MSLOCAL,MSAREA,MSIA
C THIS IS THE RATE ANALYSIS SECTION
      PRINT 31
      PRINT 32
      PRINT 33,RA1, RA4
      PRINT 34,RA2, RA5
      PRINT 35,RA6, RA8, RA9, RA10
      PRINT 36,RA3, RA7, RA11,RA12,RA13
      PRINT 37,MSGWTS
      PRINT 41
      PRINT 42
      PRINT 43
      PRINT 44
    1 FORMAT(/)
    2 FORMAT(//)
    3 FORMAT(1H-,23X,*ICA AUTODIN COST ALLOCATION MODEL SUMMARY*,/,
     X   3X,*(ANNUAL BASIS)*)
    4 FORMAT(35X,*INPUT PARAMETERS*,/)
    5 FORMAT(9X,*COSTS ($/YR)*,14X,*TECHNICAL FACTORS*,10X,*USAGE COST F
     XACTORS*,/)
    6 FORMAT(11X,*SWITCH*,2X,F8.0,6X,*AREA MEMORY*,21X,*LINE BLOCKS*,
     X   3X,F6.3)
    7 FORMAT(5X,*CONUS TRUNKS*,2X,F8.0,
     X                                12X,*CAPACITY*, 2X,F5.0,14X,*
```

```
     X     *MESSAGES*,3X,F6.3)
  8  FORMAT(3X,*OVERSEAS TRUNKS*,
     X                              2X,F8.0,6X,*AREA TRUNK*,20X,*FLASH*,1X,
     X   *WEIGHTS*,3X,F6.3)
  9  FORMAT(35X,*TERMINATIONS*,2X,F5.0)
 10  FORMAT(11X,*TOTAL*,2X,F9.0,6X,
     X          *INTER-AREA*,19X,*SURCHARGES ($/UNIT)*)
 11  FORMAT(35X,*TERMINATIONS*,F7.0,13X,* LOCAL  AREA INTER*)
 12  FORMAT(92X,*ALL  *,3F8.2)
 13  FORMAT(7X,*AUTOMEMORY*,F10.0,33X,*FLASH*,2X,3F6.2,//)
 15  FORMAT(32X,*SAMPLE CHARACTERISTICS*,/)
 16  FORMAT(9X,*DAYS OF TRAFFIC*,8X,*NUMBER OF CONNECTIONS*,
     X      10X,*VOLUME OF TRAFFIC*)
 17  FORMAT(14X,I5,13X,*SLOW*,3X,*MED*,3X,*HIGH*,3X,*TOTAL*,5X,
     X   *LBLKS*,6X,*MSGS*,2X,*LBLK/MSG*)
 18  FORMAT(3(8X,I4,2X,I4,2X,I4,3X,I6,3X,I9,2X,I8,3X,I4,/))
 19  FORMAT(15X,*TYPE OF TRAFFIC*,29X,*VOLUME OF FLASH TRAFFIC*)
 21  FORMAT(10X,*LOCAL*,9X,*AREA*,5X,*INTER-AREA*,17X,*LBLKS*,4X,*MSGS*
     X ,4X,*LBLK/MSG*)
 22  FORMAT(1X,*LBLKS*,2X,I9,4X,I9,4X,I9,6X,I7,2X,I6,5X,I4)
 23  FORMAT(2X,*MSGS*,2X,I9,4X,I9,4X,I9,//)
 31  FORMAT(35X,*RATE ANALYSIS*,/)
 32  FORMAT(1X,*COST ALLOCATION*(¢/YR)*,4X,*ACCESS CHARGES*,1X,
     X   *(¢/MO)*,8X,*UTILIZATION RATES*,1X,*($/UNIT)*)
 33  FORMAT(2X,*UTILIZATION*,2X,F9.0,3X,*BASE CHARGE*,2X,F7.2,33X,
     X *I-I*)
 34  FORMAT(1X,*CONNECTIVITY*,2X,F9.0,4X,*SLOW SPEED*,2X,F7.2,14X,
     X   *LOCAL*,5X,*AREA*,5X,*AREA*)
 35  FORMAT(29X,*MED SPEED*,2X,F7.2,6X,*LBLKS*,3(2X,F7.4))
     X   *LOCAL*,5X,*AREA*,5X,*AREA*)
 36  FORMAT(8X,*TOTAL*,F11.0,4X,*HIGH SPEED*,F9.2,*   MESSAGES*,3F9.4)
 37  FORMAT(51X,*WEIGHTS*,3F9.4,/)
 41  FORMAT(1H0,29X,*BACKBONE CHARGES BY AGENCY*)
 42  FORMAT(41X,*PERCENT BREAKDOWN*,10X,*CHARGES AS*)
 43  FORMAT(10X,*AGENCY CHARGES*,18X,*(WITHIN AGENCY)*,4X,
     X    *PERCENT OF TOTAL*)
 44  FORMAT(1X,*AGENCY*,2X,*UTILZATN*,4X,*CONNEC*,4X,*TOTAL*,
     X 5X,*UTILZATN*,2X,*CONNEC*,2X,*UTILZATN*,2X,*CONNEC*,2X,*TOTAL*)
     RETURN
     END
```

```
      SUBROUTINE TITLE
      INTEGER PAGE,KDAYS
      COMMON/PCA/KDAYS,SAMPLE
      DATA PAGE/0/
      PAGE=PAGE+1
      PRINT 1000,SAMPLE,PAGE
      RETURN
 1000 FORMAT(*1A U T O U I N - I  T R A F F I C  A N A L Y S I S      *,
     $A4,* DAY SAMPLE)*,50X,*PAGE*,I4//)
      END
```

```
      SUBROUTINE CENTER(N,I)
      INTEGER I,J,K,N,A(I),BLANK,A(132)
      DATA BLANK/1H /
      DECODE(N,1000,I)(A(I),I=1,N)
      K=N
   10 IF(A(K).NE.BLANK)GO TO 20
      K=K-1
      IF(K.GT.0)GO TO 10
      RETURN
   20 J=MAX0(1,(133-K)/2)
      PRINT 1000,(BLANK,I=1,J),(A(I),I=1,K)
      RETURN
 1000 FORMAT(133A1)
      END
```

```
      SUBROUTINE PAGE(L,N)
      INTEGER L,N
      L=L+N
      IF(L.LE.50)RETURN
      L=1
      CALL TITLE
      PRINT 1000
      RETURN
1000  FORMAT('0',18HDISTRIBUTARY',10A,'     UTILIZATION    CONNECTIVITY',10X,'TOTA
     $L'///)
      END
```

```
      INTEGER FUNCTION MATCH(A,K,N)
      INTEGER A(K),N(1)
      DO 10 I=1,K
   10 IF(A(I).EQ.N(I)) GO TO 20
      I =
   20 MATCH = I
      RETURN
      END
```

```
      INTEGER FUNCTION SPDCLS(N)
      INTEGER N
      IF(N.GE.2400)GO TO 10
      SPDCLS=1
      IF(N.GE.600)SPDCLS=2
      RETURN
   10 SPDCLS=3
      RETURN
      END
```

```
      REAL FUNCTION TOTAL(N,A,M)
      INTEGER I,J,N,M
      REAL A(1)
      TOTAL=0
      J=1
      DO 10 I=1,N
      TOTAL=TOTAL+A(J)
10    J=J+M
      RETURN
      END
```

```
      INTEGER FUNCTION SUM(K,N,MR)
      INTEGER K,N(15),MR,J
      SUM = 1
      J = 1
      DO 10 I=1,K
      SUM = SUM * N(J)
   10 J = J+MR
      RETURN
      END
```

```
      SUBROUTINE CLEAR(N,X)
      INTEGER I,N
      REAL X(1)
      DO 10 I=1,N
   10 X(I)=0
      RETURN
      END
```

APPENDIX D

AUTODIN USAGE AND BUDGET DATA

AUTODIN USAGE AND BUDGET DATA

The following tables, assembled from similar tables furnished by DCA, are offered to provide perspective on the cost allocation history of the AUTODIN system.

Table D-1*

DEFENSE COMMUNICATIONS AGENCY
COMMUNICATIONS SERVICES INDUSTRIAL FUND
BUDGET ESTIMATE

TOTAL REVENUES AND EXPENSES
(Dollars in Thousands)

Description	FY 1974 Actual	FY 1975 Actual	FY 1976 Actual	FY 19TQ Estimate	FY 1977 Estimate	FY 1978 Estimate
A. Revenues						
AUTOVON	82,280	78,890	75,396	18,203	85,146	88,833
AUTODIN	53,688	52,550	43,277	10,319	48,587	53,869
All Other Leased Communications Services	254,216	250,117	256,922	64,978	257,567	257,498
Total Revenue	390,184	381,557	375,595	93,500	291,300	400,200
B. Expenses						
Contractual Services						
AUTOVON	82,463	81,684	79,764	19,837	78,297	87,101
AUTODIN	52,289	47,753	45,003	11,506	47,358	50,657
All Other Leased Communications Services	251,687	247,902	256,363	64,903	258,240	248,758
Overhead (DECCO Operations)						
Salaries & Related Expenses	2,829	3,082	3,274	863	3,613	3,786
Contractual Services	298	676	348	85	564	636
Materials & Supplies	105	172	98	25	101	110
Other	274	387	372	181	427	452
Total Expenses	389,945	381,656	385,222	97,400	388,600	391,500
Non-Add: Military Personnel Services	(819)	(856)	(869)	(218)	(892)	(906)

*Source of all tables in Appendix D is the Defense Communications Agency.

Table D-2

DEFENSE COMMUNICATIONS AGENCY
COMMUNICATIONS SERVICES INDUSTRIAL FUND
BUDGET ESTIMATE

CUSTOMER REVENUES - ALL MISSIONS
(Dollars in Thousands)

Description	FY 1974 Actual	FY 1975 Actual	FY 1976 Actual	FY TQ Estimate	FY 1977 Estimate	FY 1978 Estimate
Army						
AUTOVON	19,739	19,225	18,022	4,341	20,743	20,445
AUTODIN	13,294	14,324	12,372	2,943	14,073	16,386
All Other Leased Communications Services	50,042	48,560	48,504	11,870	38,999	37,379
Sub Total	83,075	82,109	78,898	19,154	73,815	74,210
Navy						
AUTOVON	14,090	14,083	13,628	3,277	15,151	15,800
AUTODIN	10,470	10,924	10,219	2,446	11,161	9,763
All Other Leased Communications Services	27,675	29,711	30,758	7,947	33,187	35,827
Sub Total	52,235	54,718	54,605	13,670	59,499	61,390
Air Force						
AUTOVON	43,851	40,669	39,049	9,517	44,173	47,076
AUTODIN	24,473	21,128	15,312	3,752	17,057	18,362
All Other Leased Communications Services	112,439	105,435	102,793	26,079	106,160	103,363
Sub Total	180,763	167,232	157,154	39,348	167,390	168,801
Other DoD						
AUTOVON	3,737	4,097	3,941	896	4,161	4,683
AUTODIN	4,694	5,484	4,273	910	5,078	8,319
All Other Leased Communications Services	11,604	12,786	15,834	4,237	16,752	14,122
Sub Total	20,035	22,367	24,048	6,043	25,991	27,124
Other Non-DoD						
AUTOVON	863	816	756	172	918	829
AUTODIN	757	690	1,101	268	1,218	1,039
All Other Leased Communications Services	52,456	53,625	59,033	14,845	62,469	66,807
Sub Total	54,076	55,131	60,890	15,285	64,605	68,675
TOTAL REVENUE	390,184	381,557	375,595	93,500	391,300	400,200

(Intentionally Blank)

Table D-3

DEFENSE COMMUNICATIONS AGENCY
COMMUNICATIONS SERVICES INDUSTRIAL FUND
BUDGET ESTIMATES
AUTODIN
ANALYSIS OF REVENUE FROM COMMON USER

(By number subscribers, weighted units and thousands of dollars)

Customer/ Service Offering (Baud)	FY 1974 - Actual				FY 1975 - Actual				FY 1976 - Actual				FY 19TQ -	
	Subscribers E/Y	Avg	Wt. Units	Dollars	Subscribers E/Y	Avg	Wt. Units	Dollars	Subscribers E/Y	Avg	Wt. Units	Dollars	Subscribers E/Y	Avg
Army														
Mag Tape (2400/4800)	39	35	10,190	3,821	42	42	13,392	4,861	43	43	7,177	3,840	43	43
High Speed (1200)	48	47	9,024	3,384	38	39	8,256	3,650	42	40	4,320	2,311	42	42
Intermediate (600)	46	49	7,056	2,646	45	40	6,048	2,375	46	46	4,968	2,658	46	46
Medium Speed (300)	34	34	3,264	1,224	35	40	3,840	1,205	32	34	1,224	655	30	30
Low Speed (150)	49	50	2,400	900	41	44	2,112	939	28	35	1,260	674	28	28
TTY (75)	142	147	3,528	1,319	126	130	3,120	1,294	106	116	4,176	2,234	106	106
TOTAL	358	362	35,462	13,294	327	335	36,768	14,324	297	314	23,125	12,372	295	295
Navy														
Mag Tape (2400/4800)	8	8	2,422	901	9	9	2,736	1,213	7	8	1,344	719	7	7
High Speed (1200)	63	64	12,288	4,578	70	68	13,056	4,781	67	68	7,344	3,929	70	70
Intermediate (600)	15	15	2,160	804	17	16	2,016	638	15	16	1,728	924	14	14
Medium Speed (300)	36	38	3,648	1,357	35	34	3,264	1,490	33	34	1,224	655	38	38
Low Speed (150)	51	53	2,544	946	45	47	2,400	1,330	43	43	1,521	814	40	40
TTY (75)	195	211	5,064	1,884	181	183	4,560	1,472	161	165	5,940	3,178	158	158
TOTAL	368	389	28,126	10,470	357	357	28,032	10,924	326	334	19,101	10,219	327	327
Air Force														
Mag Tape (2400/4800)	39	38	10,682	4,753	37	38	11,232	3,506	35	35	5,796	3,101	40	40
High Speed (1200)	97	99	19,008	8,459	73	75	14,976	7,505	65	69	7,452	3,987	66	66
Intermediate (600)	58	56	8,064	3,588	49	48	6,912	3,293	45	46	4,860	2,600	45	45
Medium Speed (300)	106	102	9,792	4,357	139	139	13,344	4,723	138	138	4,968	2,658	136	136
Low Speed (150)	75	83	3,984	1,772	48	50	2,640	943	26	37	1,332	713	26	26
TTY (75)	133	144	3,456	1,544	128	130	3,240	1,158	106	114	4,213	2,253	117	117
TOTAL	508	522	54,986	24,473	474	480	52,344	21,128	415	439	28,621	15,312	430	430
Other DoD														
Mag Tape (2400/4800)	22	20	6,353	2,408	24	24	7,728	3,398	24	24	4,032	2,157	27	27
High Speed (1200)	18	18	3,456	1,310	17	18	3,725	1,275	15	16	1,728	924	17	17
Intermediate (600)	8	8	1,152	437	7	7	1,008	424	8	8	864	462	8	8
Medium Speed (300)	1	1	96	36	5	3	192	35	4	3	117	63	2	2
Low Speed (150)	6	6	288	109	7	7	336	122	8	8	288	154	7	7
TTY (75)	22	22	1,056	394	26	26	480	230	20	23	849	513	23	23
TOTAL	77	75	12,401	4,694	86	85	13,469	5,484	79	82	7,878	4,273	84	84
Non-DoD														
Mag Tape (2400/4800)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High Speed (1200)	1	1	192	76	2	2	390	144	2	2	216	109	1	1
Intermediate (600)	4	3	362	143	2	4	448	213	2	3	324	168	2	2
Medium Speed (300)	2	1	86	34	3	3	240	107	1	2	72	37	3	3
Low Speed (150)	4	4	142	56	2	4	183	71	4	4	144	74	5	5
TTY	52	52	1,139	448	44	48	608	154	42	42	1,410	713	40	40
TOTAL	63	61	1,921	757	53	61	1,869	690	51	53	2,166	1,101	51	51
Total AUTODIN Revenue	1,374	1,409	132,896	53,688	1,297	1,318	132,482	52,550	1,168	1,222	80,891	43,277	1,187	1,187

[1]The increase in weighted units, over FY 1977, is due to the inclusion of those weighted units associated with the off-base term back-side of Automated Message Processing Equipment (AMPE).

	FY 19TQ - Estimate				FY 1977 - Estimate				FY 1978 - Estimate			
	Subscribers		Wt.		Subscribers		Wt.		Subscribers		Wt.	
Dollars	E/Y	Avg	Units	Dollars	E/Y	Avg	Units	Dollars	E/Y	Avg	Units	Dollars
3,840	43	43	1,785	932	48	46	7,644	4,525	64	64	10,668	5,387
2,311	42	42	1,134	592	55	49	5,292	3,133	85	90	9,720	4,909
2,658	46	46	1,242	648	45	45	4,860	2,877	38	43	4,644	2,345
655	30	30	270	141	22	22	792	469	23	23	828	418
674	28	28	252	132	28	28	1,008	597	34	34	1,224	618
2,234	106	106	954	498	116	116	4,176	2,472	124	149	5,364	2,709
12,372	295	295	5,637	2,943	314	306	23,772	14,073	368	403	32,448	16,386
719	7	7	294	153	12	10	1,680	995	12	12	2,016	1,018
3,929	70	70	1,890	987	71	71	7,668	4,540	67	70	7,560	3,819
924	14	14	378	197	15	13	1,404	831	15	15	1,620	818
655	38	38	342	179	39	39	1,404	831	53	47	1,692	854
814	40	40	360	188	46	46	1,656	980	58	51	1,836	927
3,178	158	158	1,422	742	140	140	5,040	2,984	106	128	4,608	2,327
10,219	327	327	4,686	2,446	323	319	18,852	11,161	311	323	19,332	9,763
3,101	40	40	1,680	877	47	41	6,888	4,078	48	48	8,064	4,072
3,987	66	66	1,782	930	66	66	7,128	4,220	70	70	7,560	3,818
2,600	45	45	1,215	634	44	44	4,752	2,813	99	99	10,692	5,399
2,658	136	136	1,224	639	136	136	4,896	2,898	136	136	4,896	2,472
713	26	26	234	122	26	26	936	554	26	26	936	474
2,253	117	117	1,053	550	117	117	4,212	2,494	117	117	4,212	2,127
15,312	430	430	7,188	3,752	436	430	28,812	17,057	496	496	36,360	18,362
2,157	27	27	780	407	29	29	4,872	2,884	29	29	4,872	2,461
924	17	17	459	240	16	16	1,728	1,023	86	86	9,334	4,714
462	8	8	216	113	8	8	864	511	9	9	972	491
63	2	2	18	10	1	1	36	21	2	2	72	36
154	7	7	63	32	7	7	252	149	9	9	324	163
513	23	23	207	108	23	23	828	490	25	25	900	454
4,273	84	84	1,743	910	84	84	8,580	5,078	160	160	16,474	8,319
0	0	0	0	0	0	0	0	0	0	0	0	0
109	1	1	27	14	1	1	108	64	1	1	108	55
168	2	2	54	28	2	2	216	128	2	2	216	109
37	3	3	28	15	3	3	108	64	3	3	108	55
74	5	5	45	23	5	5	180	107	5	5	180	91
713	40	40	360	188	40	40	1,446	855	40	40	1,446	729
1,101	51	51	514	268	51	51	2,058	1,218	51	51	2,058	1,039
43,277	1,187	1,187	19,768	10,319	1,208	1,190	82,074	48,587	1,386	1,433	106,672[1]	53,869

ith the off-base terminals on the

Table D-4

DEFENSE COMMUNICATIONS AGENCY
COMMUNICATIONS SERVICES INDUSTRIAL FUND
FY 1978 BUDGET ESTIMATE

ANALYSIS OF AUTODIN BACKBONE PROGRAM AND EXPENSES
(Dollars in Thousands)

Description	FY 1976 - Actual Number	FY 1976 - Actual Costs	FY 19TQ - Estimate Number	FY 19TQ - Estimate Costs	FY 1977 - Estimate Number	FY 1977 - Estimate Costs	FY 1978 - Estimate Number	FY 1978 - Estimate Costs
Program Data								
Number of Operational Switches (E/Y)								
CONUS	8	XXX	8	XXX	8	XXX	8	XXX
Overseas (Includes Hawaii)	9	XXX	9	XXX	9	XXX	9	XXX
Expenses								
Switching Centers								
Leased Switches		29,322		7,450		30,168		32,372
Amortization		626		153		701		690
O&M of Switching Centers		11,794		3,043		12,918		13,890
Other and Non-Recurring		158		45		195		215
Total Switching Centers		41,900		10,691		43,982		47,167
Trunks (Number E/Y)								
CONUS	20	333	20	90	20	356	20	384
Overseas								
Europe	9	675	11	185	11	752	11	813
Pacific	12	972	12	245	12	1,030	12	1,115
Total Trunks	41	1,980	43	520	43	2,138	43	2,312
AUTOVON Support (Interconnects)		1,122		295		1,238		1,178
Overhead		436		120		470		497
SUB-TOTAL		--		--		--		--
FY 1978 Add-On for Prior FY Losses		--		--		--		2,710
TOTAL AUTODIN BACKBONE EXPENSE		45,438		11,626		47,828		53,864
NON-ADD: MILITARY PERSONNEL SERVICES		(153)		(38)		(161)		(172)