UNIVERSITY OF CALIFORNIA

LICK OBSERVATORY TECHNICAL REPORTS

No. 7

THE GAERTNER AUTOMATIC MEASURING SYSTEM
Machine Language Listings for AME Controls

L. B. Robinson and F. M. Melsheimer

Santa Cruz, California
May 1974

Index

Introduction

The machine language subroutines listed here include those needed to enable special commands in Lick FOCAL on the PDP 8, that control the Gaertner Automatic Measuring Engine (AME). Rules for use of the commands and a FOCAL program for operation of the measuring engine are given in Lick Technical Report No. 6

The ASCII source listings are available on DECtape No. 15C, and on File 3, DECtape 15C.

Acknowledgements

Purchase and installation of the PDP 8/I computer at the AME were supported by NSF Grant GP 32459.

(1)

AME CORE MAP: FIELD 1 JAN/74

0-5	FOCAL
6-44	CONϕ
10-17	ARG3H--ARG10H
45-47	-FREE
50-61	ARG1--ARG10
62-66	GCON
67-70	-FREE
71-72	GCON
73-75	-FREE
76-77	GCON

100-103	FREE
104-111	GCON
112-130	CONϕ
132-137	
131	FREE
140--237	KB1 TABLE
240--560	FOCAL
561--2563	TEXT
2600-4777	IBM, Name Buffer
6000-7777	FOCAL, ETC.
7371-7372	Kilall - STOP STAGE

(1)

6042-	
6151-6177	VAR
6200-6272	PHOT
6300-6363	SCAN
6400-6532	MISC
6551-6576	BUZ
6600-6710	COR
6720-6735	SWTA
6737-6777	FINK

(4)

6043-6075	SHIF
6100-6110	DIS
6112-6140	TOTL
6155-6177	SURV
6200-6231	TOTO
6232-6256	LPUT
6304-6325	PUTN
6327-6577	SURV
6600-6774	CHAIN

(2)

6044-6343	LIST
6366-6540	CRT
6545-6576	SAV4
6600-6760	(CRT)
6770-6777	(SAV4)

(5)

6200-6347	MOVE
6350-6570	TAPO
6600-6646	MICR
6650-6764	JOY
6775-6777	ALOC

(3)

6042-6107	SAVX
6200-6376	NAME
6422-6774	SWIT

(6)

"SORT" or
"IBM" are
entered here by
X NAME ( ).

XTRA: 15000-15777;
5000-5165: MOVE
5200-5352: STEP
5400-5571: MICR

5601-5670: ALOC
5671-5720: COMD
5721-5777: BCD

Load LABL LAST!

Machine Language Coding - IOT Commands

The machine language coding sequences needed to operate the AME are somewhat more complex than might be expected. This is because in order to minimize the number of cables between the computer and the Measuring Engine control circuits, an elementary multiplexing scheme is used. Control words are sent down a single 12 bit cable and routed into one of several control registers, depending on which of the three least significant bits are set.

Measuring Engine data from 20 or so 12 bit registers are read to the computer along a single 12 wire cable, by enabling one set of 12 gates from only one of the registers at a time.

The IOT commands are listed below:

6721 - - Start AME

6722 - SKIPAM - Skip on selected AME flag

6723 - SETAME - Load AME command register

6724 - AMEGO1 - Start selected AME function

6725 - ARESET - Reset selected AME function

6726 - - Unused

6727 - READAM - Read AME data or status

6731 - - Unused

6732 - - Skip on survey flag

6733 - MOVAME / SETSUR - Load survey or drive selection register

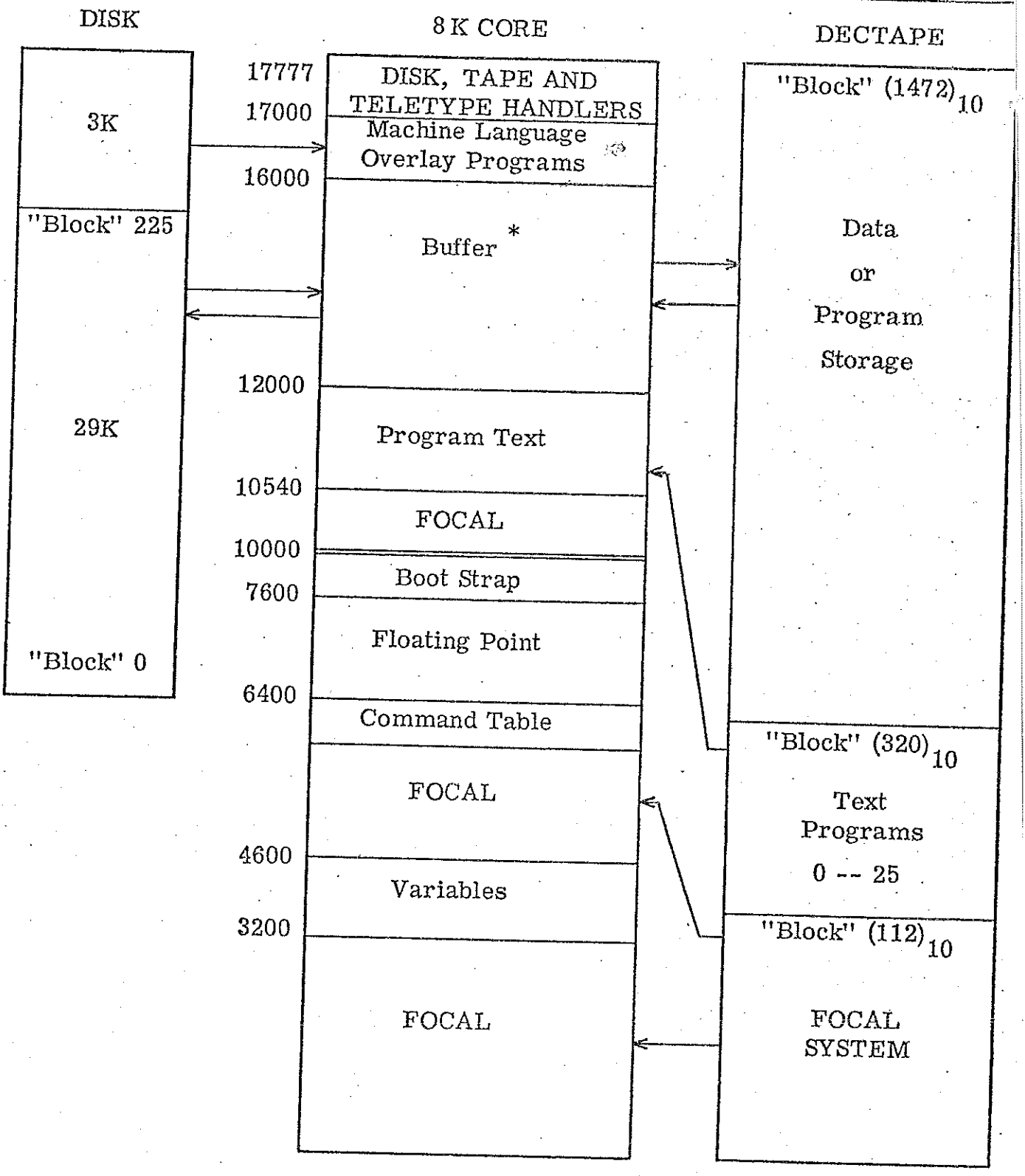
6734 - - Clear survey flag

6735 - - Set 3 digit image No. display

6736 - SETLOC - Set 5 digit position display

6737 - REDSUR - Read survey data

PDP 8 Memory Utilization for Lick-FOCAL



*The buffer is used as a data buffer for the disk, DECtape and IBM tape. For the Microphotometer and Automatic Measuring Engine, part of the buffer (12000 - 12565) is used for FOCAL program text, and part (15000 - 15777 is used for core resident programs.

DISPATCH TABLE ALLOCATIONS

LICK FOCAL 1974

KB1 +	Scanner	Microphoto	AME
0	PUT	PUT	PUT
1	(F)TAK	(F)TAK	(F)TAK
2	CALL	CALL	CALL
3	FILE	FILE	FILE
4	END	END	END
5			JOY
6	STOR	STOR	STOR
7	(F)ASK	(F)ASK	(F)ASK
10	CRT		SAVX
11			SAVY
12	SWIT	SWIT	SWIT
13			STEP
14	MSAV	UP	COR
15	MGET	DN	GMIC
16	CLER	LFT	MICR
17		RIT	MICS
20	SAV	SHFT	LOC
21	PUL	SET	SCNR
22	CHAN	(F)UNC	GSCN
23	IN	IFIX	SCNS
24	OUT		
25	SHFT		SHFT
26	EDIT		PHOR
27	ERAS	~~ERMD~~	GPHO
30	DIVD	DIVM	PHOS
31		ICRT	SWTA
32	MOVE	COMP	
33	PUTN	PUTN	PUTN

KB1 +	SCN	MIC	AME
34		PEN	SURV
35		PLOT	PLOT
36	DIS	DIS	DIS
37	STAT	STAT	STAT
40	NAME	NAME	NAME
41	WHAT	WHAT	WHAT
42		SHOW	IN
43		ADD	OUT
44		SUB	IOR
45			TEST
46	FORM		CLER
47	LOOK		AND
50		MINM	AME
51	TOTL	TOTL	TOTL
52	COMP	ZCOM	DISP
53	CPEN	CPEN	SWTS
54			ALOC
55	PAUS		MOV
56	GO	GO	GO
57	DO	DO	DO
60	ZCOM	PUTL	PUTL
61		TAKL	TAKL
62	PEAK	CONV	BUZ
63	VAR	MULT	VAR.
64	MPUT	MPUT	MPUT
65	MTAK	MTAK	MPUT

X NAME( ) overlays locations from KB1+66 to KB1+77.

AME FOCAL CROSS INDEX

PROGRAM	CALL	POINTER
ALOC	ALOC	ALOCX(107)
BCD		BCDBNX (111)
BUZ	BUZ	
COMD		COMNDX (110)
CHAIN	CALL END FILE	
CRT	STAT	
COR	COR	
DIS	DIS	
FINK	FIN FOUT	
GOTO	GO DO	
IBM	ALL IBM FUNCTIONS	
JOY	JOY	STEPX(153)
LPUT	PUTL TAKL	
MICR	GMIC MICR MICS LOC	LOCX(105) READAX(106)
MISC	OR TEST CLER AND AME	
MOVE	MOV	
NAME	NAME WHAT	
PHOT	PHOR GPHO PHOS	
PUTN	PUTN	
SAV4	STOR ASK	
SAVX	SAVX SAVY	
SCAN	SCNR GSCN SCNS	
SHIF	SHFT	
SORT	SORT	
STEP	STEP (JOY)	FINDX(104)
SURV	DISP SURV SWTS	
SWIT	SWIT	
SWTA	SWTA	
TAPO	MPUT MTAK	
TOTL	TOTL	
VAR	VAR	

	FOCAL SYSTEM	
GWRD	PUT TAK	GETWRX PUTWRX BWRITX 137 MVBUFX 124
IOUT		FLAGX 123 WAITX 125 KILALL 132 DTAPX 21 DISCX 20
LFOC		TYPEX 127 CRLFX 130 INTESX 117 OCTPNX 136
MESG		MESAGX 22

LOADING A MODIFIED DISC OVERLAY INTO AME FOCAL

(3)

(TAPE 15B - Source)

```
.
.
.GFOC
.XTRA
.LOAD
*IN-S:MOVE,S:TAPO,S:MICR
*
*
*
ST=
↑↑↑↑ <P>        ≡ CTRL P
.LOAD
*IN-S:JOY,S:ALOC,S:LABL
*
*
*
ST=
↑↑↑↑ <P>
.SAVE XTRA!15000-5777;
.SET1
.STOR
PROG NO.(1--6):5

SAVE SET1!500-6777;
...'FOC!10000-1177,6000,7000-7577;1000
.SAVE SET1!500-6777;
.SAVE GFOC!10000-1177,6000,7000-7577;1000
.PUTT
SET TAPE 8 TO WRITE ENABLED.
FILE NO.(0-4):3
 FILE 3 FULL.TYPE Y TO REUSE IT :Y
DONE!
.PIP
*OPT-S

*OUT-D0:GFOC
*
*IN-S:GFOC
*↑
*OPT-  (CTRL-C)
.
.FAST
.SET1
.XTRA
.TAPE
.GFOC
.STEN
*W
C:LICK FOCAL AME74-B  E0@@
*1.01 C-JAN.31/74--FIXED 'MOV'
*31.9 X CALL(6,1)
*
DONE!
*
*
```

MOUNT FOCAL TAPE
UNIT 8, WRITE ENABLED.
(Manually) START AT 12000.

File 3 Tape 15B
JAN. 2/74

(4)

```
.PALP
*OUT-S:ALOC
*
*IN-S:CON0,S:GCON,S:ALOC
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /ALOC
                /X ALOC (X,Y) SETS AME POSITION IN DISPLAY LAMPS.
                /
                *ALOCX
0107   5601     LOADIT
                /
                LETR=ARG1
                TEMP=5600       /SEE 'COMD'
                /
                SETLOC=6736
                *KB1+54
0214   6775     LOADEM
                *FNKB1+54
0720   2073     2073    /ALOC
                /
                *6775
6775   0000     LOADEM,0
6776   4507       JMS I ALOCX
6777   5775       JMP I LOADEM
                /
                *5601   /CORE RESIDENT CODE
5601   0000     LOADIT,0
5602   7330       STL CLA RAR   /4000 FOR X SELECT
5603   3050       DCA LETR
5604   1052       TAD ARG3
5605   7421       MQL
5606   1010       TAD ARG3H
5607   4216       JMS ARITH
5610   3050       DCA LETR      /0 FOR Y
5611   1053       TAD ARG4
5612   7421       MQL
5613   1011       TAD ARG4H
5614   4216       JMS ARITH
5615   5601       JMP I LOADIT
                /
5616   0000     ARITH,0
5617   7407       DVI
5620   1750       1750          /DIVIDE BY 1000 TO GET TOP 2 DIGITS
5621   3200       DCA TEMP      /REMAINDER IS 3 LOW DIGITS
5622   4246       JMS BCD       /CONVERT MQ TO BCD
5623   0267       AND P377
5624   1266       TAD HI        /CODE TO SELECT BUFFER DECADES
5625   1050       TAD LETR
```

(5)

```
5626  6736    SETLOC
5627  1200    TAD TEMP
5630  7421    MQL             /NOW CONVERT LO 3 DECADES
5631  4246    JMS BCD
5632  7421    MQL             /NOW SET 3 LO DECADES
5633  7501    MQA
5634  0267    AND P377
5635  1050    TAD LETR
5636  1265    TAD LO          /LO DECADES
5637  6736    SETLOC
5640  7413    SHL
5641  0007    7
5642  0270    AND P360
5643  1050    TAD LETR        /HI DECADE SELECT CODE IS 0
5644  6736    SETLOC
5645  5616    JMP I ARITH
              /
5646  0000  BCD,0
5647  7407    DVI
5650  0012    12
5651  3051    DCA ARG2        /RENAINDER IS LOWEST DECADE
5652  7407    DVI
5653  0012    12
5654  7006    RTL
5655  7006    RTL             /MIDDLE DECADE IS REMAINDER NOW
5656  1051    TAD ARG2
5657  3051    DCA ARG2
5660  7413    SHL
5661  0023    23
5662  1051    TAD ARG2        /THE TOP DECADE WAS IN MQ
5663  7040    CMA
5664  5646    JMP I BCD
              /
5665  1000  LO,1000
5666  2000  HI,2000
5667  0377  P377,377
5670  0360  P360,360
```

```
.PALP
*OUT-S:BCD
*
*IN-S:CONØ,S:GCON,S:BCD
*
*
*
*OPT-T

AMEGO1  6724

                /CONØ
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /BCD
                /CONVERTS BCD IN ARG1,ARG2 TO BINARY
                /
                *BCDBNX
0111    5721    BCDBIN
                /
                *5721
5721    0000    BCDBIN,Ø
5722    3376      DCA LOW       /CLEAR BUFFERS
5723    3375      DCA HI
5724    1050      TAD ARG1      /CONVERT HI PART
5725    4335      JMS BCD12     /INPUT IS IN BCD
5726    1051      TAD ARG2      /CONVERT LOW PART
5727    4335      JMS BCD12
5730    1375      TAD HI
5731    3050      DCA ARG1
5732    1376      TAD LOW
5733    3051      DCA ARG2
5734    5721      JMP I BCDBIN
                /
5735    0000    BCD12,Ø
5736    3377      DCA WORD
5737    4343      JMS CHARBD
5740    4343      JMS CHARBD
5741    4343      JMS CHARBD
5742    5735      JMP I BCD12
                /
5743    0000    CHARBD,Ø
5744    1375      TAD HI
5745    7425      MQL!MUY
5746    0012      12            /HI PART X 10
5747    7701      CLA!MQA
5750    3375      DCA HI        /ASSUME HI PART NEVER OVERFLOWS
5751    1376      TAD LOW
5752    7425      MQL!MUY       /LOW PART X 10
5753    0012      12
5754    1375      TAD HI        /LOW PART CAN OVERFLOW
5755    3375      DCA HI
5756    7501      MQA
5757    3376      DCA LOW
5760    7430      SZL
5761    2375      ISZ HI        /CARRY
5762    1377      TAD WORD
```

(7)

```
5763  7421    MQL
5764  7413    SHL
5765  0003    3               /GET NEXT TOP 4 BITS
5766  1376    TAD LOW         /ADD 1 BCD CHARACTER
5767  3376    DCA LOW
5770  7430    SZL
5771  2375    ISZ HI          /CARRY
5772  7501    MQA
5773  3377    DCA WORD
5774  5743    JMP I CHARBD
              /
5775  0000    HI,0
5776  0000    LOW,0
5777  0000    WORD,0
```

File 3 Tape 15B
Dec 7/73

(8)

```
.PALP
*OUT-S:BUZ
*
*IN-S:CON0,S:GCON,S:BUZ
*
*
*
*OPT-I

ALOCX  0107

               /CON0
               XLIST
               PAUSE/
               /GCON
               XLIST
               PAUSE/
               /
               /BUZ
               /X BUZ(N) SET BUZZER FOR N CYCLES.LEAVE ON IF -VE.
               /STOP IF N=0
               /
               *INKB1+62
0726   0002    2          /BUZ
               *KB1+62
0222   6551    TONE
               /
               *6551
6551   0000    TONE,0
6552   1052      TAD ARG3
6553   7041      CIA
6554   3052      DCA ARG3
6555   1052    CYCLE,TAD ARG3
6556   7650      SNA CLA
6557   1037      TAD P20
6560   1376      TAD P7757
6561   6733      SETSUR
6562   7200      CLA
6563   2031      ISZ TEMPS0      /DELAY
6564   5363      JMP .-1
6565   2010      ISZ ARG3H       /TEST -VE N
6566   5370      JMP PLUS
6567   5374      JMP EXIT
6570   2052    PLUS,ISZ ARG3
6571   5355      JMP CYCLE
6572   7240      CLA CMA
6573   6733      SETSUR          /TURN IT OFF
6574   7300    EXIT,CLA CLL
6575   5751      JMP I TONE
               /
6576   7757    P7757,7757
```

This could leave the Buzzer on, if CTRL-C.

File 3 Tape 15B
JAN. 2 /74

(9)

```
.PALP
*OUT-S:COMD
*
*IN-S:GCON,S:COMD
*
*
*OPT-T

ALOCX  0107

                /
                /GCON
                XLIST
                PAUSE/
                /
                /COMD
                /CORE RESIDENT CODE THAT PROVIDES PULSE SEQUENCE
                /TO LOAD THE AME CONTROL BUFFER REGISTER.
                /NULL AND FULL COUNT CHECK BITS ARE TAKEN FROM PREVIOUS
                /COMAND IF LINK =1.
                /
                TEMP=5600       /SEE 'ALOC'
                /
                FIELD 1
                *COMNDX
0110   5671     COMAND
                *5671   /SAVED IN 'XTRA'
5671   0000     COMAND,0
5672   0314       AND P7770
5673   3200       DCA TEMP
5674   1200       TAD TEMP
5675   7430       SZL             /CLER SETS LINK
5676   5310       JMP GETOLD      /DON'T CHANGE STATE WHEN RESETTING.
5677   0317       AND P600
5700   3320       DCA CHECK       /SAVE NULL AND FCC.
5701   1200       TAD TEMP
5702   1315     DOIT,TAD P3       /SELECTS BIT 9
5703   6723       SETAME
5704   1200       TAD TEMP
5705   1316       TAD P7          /DESELECTS BIT 9
5706   6723       SETAME          /UP AND DOWN CONTROL BIT TO LOAD BUFFER.
5707   5671       JMP I COMAND
                /
5710   0313     GETOLD,AND P7170        /REMOVE CURRENT NULL,FCC
5711   1320       TAD CHECK     /GET PREVIOUS ONES
5712   5302       JMP DOIT
                /
5713   7170     P7170,7170
5714   7770     P7770,7770
5715   0003     P3,3
5716   0007     P7,7
5717   0600     P600,600
5720   0000     CHECK,0
```

Tape 14C
Nov. 3/72

(10)

```
.PALP
*OUT-S:CHAIN
*
*IN-S:CON0,S:CHAIN
*
*
*OPT-T

ALSET  6660

                /CON0
                XLIST
                PAUSE/
                /
                /CHAIN-CHAINING PROGRAM
                /X FILE(N) TO STORE PROGRAM N
                /X CALL(N,SB,Q) TO CALL PROGRAM N,SUBROUTINE SB
                /X END(0) WILL THEN CONTINUE ORIGINAL PROGRAM.
                /IF Q IS >0 CALLS CAN BE NESTED.
                /
                /PROGRAMS START AUTOMATICALLY IF SB IS NON-ZERO.
                /LINE AB.XY CAN BE CALLED BY SB=128*AB+XY
                /
                CHBUFR=7150
                ERR2=2726
                /
                *PGRETN
0135   7150     CHBUFR
                *KB1+2
0142   6616     CHACAL
0143   6671     CHAPUT
0144   6750     XEND
                /
                *FNKB1+2
0646   2554     2554      /CALL
0647   2545     2545      /FILE
0650   0164     164       /END
                /
                FIELD 0
                *3120    /ENTERED FROM ALSET
3120   3060     LINFIN,DCA BUFR /NEW END OF TEXT
3121   7501       MQA
3122   7450       SNA
3123   5177       JMP 177          /NO LINENO,DON'T START.
3124   3067       DCA LINENO       /NEW FIRST LINE NO.
3125   4555       FINDLN
3126   7000       OPR  /LINE NOT FOUND
3127   6774       DTLB /SET FIELD 0 FOR MONITOR IN CASE ARG4 IS 0
3130   7001       IAC
3131   3065       DCA NAGSW        /ALL TEXT
3132   6001       ION
3133   4540       PUSHJ
3134   0606       606              /GO, AFTER FINDLN
3135   5736       JMP I .+1
3136   0273       273
                /
                FIELD 1
                *6600
6600   0000     CHAIN,0
6601   1052       TAD ARG3
```

```
6602  7106      CLL RTL
6603  7004      RAL                 /8 BLOCKS PER PROGRAM
6604  1044      TAD FSPROG          /FIRST BLOCK USED
6605  3027      DCA DTBLOK
6606  1006      TAD CLENGT          /CHAIN LENGTH
6607  3024      DCA DDWCNT
6610  3030      DCA DTUNIT          /TAPE 8
6611  1121      TAD LINPNT          /START OF TEXT (BFTEMP) - See LFOC
6612  3023      DCA DDCORE
6613  1346      TAD P10
6614  3026      DCA DSFELD
6615  5600      JMP I CHAIN
                /
6616  0000    CHACAL,0
6617  1054      TAD ARG5
6620  7640      SZA CLA
6621  5224      JMP NEST
6622  1372    FIXT,TAD PZERO
6623  3135      DCA PGRETN
6624  6203    NEST,CIF!CDF
6625  1135      TAD PGRETN
6626  1374      TAD MINMAX
6627  7700      SMA CLA
6630  4771      JMS I ERRORP        /TOO MANY NESTED CALLS
6631  1773      TAD I PCX           /SAVE PC
6632  6213      CDF!CIF 10
6633  3016      DCA 16
6634  1416      TAD I 16            /PC POINTS TO CURRENT LINENO
6635  7001      IAC                 /X END(0) WILL RETURN TO NEXT LINE
6636  2135      ISZ PGRETN
6637  3535      DCA I PGRETN
6640  1042      TAD PGLAST
6641  2135      ISZ PGRETN
6642  3535      DCA I PGRETN
6643  4200    CDO,JMS CHAIN
6644  4421      JMS I DTAPX
6645  5243      JMP .-2             /TAPE ERROR
6646  1052      TAD ARG3            /RETURNS HERE WITH INTERRUPT OFF.
6647  3042      DCA PGLAST          /NEW PROGRAM NO.
6650  1053      TAD ARG4
6651  7421      MQL
6652  7501      MQA
6653  0266      AND P7600
6654  7640      SZA CLA
6655  5260      JMP ALSET           /GROUP NUMBER FOUND
6656  7413      SHL
6657  0006      6                   /LESS THAN 200,CHANGE TO A GROUP NO.
6660  7200    ALSET,CLA
6661  1522      TAD I LØTPNT        /LØTEMP
6662  3747      DCA I LØPNT         /LINEØ
6663  1521      TAD I LINPNT        /BFTEMP
6664  6203      CDF CIF
6665  5667      JMP I LINFIX
                /
                /BFTEMP STORES "BUFR". LØTEMP STORES C(LINEØ)
                /
6666  7600    P7600,7600
6667  3120    LINFIX,LINFIN
6670  0060    BUFPNT,BUFR
                /
```

```
6671  0000  CHAPUT,0          /STORE FROM C(LINPNT) FOR 2010 WORDS
6672  4422     JMS I MESAGX
6673  0275  TEXT /B=
6674  6100  1/
6675  6201     CDF
6676  1670     TAD I BUFPNT
6677  6211     CDF 10
6700  3521     DCA I LINPNT /BFTEMP
6701  1521     TAD I LINPNT
6702  4536     JMS I OCTPNX /PRINT LAST TEXT ADDRESS
6703  4200     JMS CHAIN
6704  2053     ISZ ARG4     /FORCE GETWRX (NEEDS NON-ZERO)
6705  4541    JMS I GETWRX
6706  2116    ISZ BLOKIN    /IN CASE BLOKIN=ARG3
6707  4541    JMS I GETWRX  /SAVES DISK BUFFER AND SETS POINTERS.
6710  7240     CLA CMA
6711  3116     DCA BLOKIN   /DISC BUFFER TO BE ERASED
6712  4421     JMS I DTAPX  /READ FIRST BLOCK BEFORE CHANGING IT
6713  5312     JMP .-1      /TAPE ERROR
6714  1666     TAD I P7600  /SECOND BUFFER WORD IS L0TEMP
6715  7650     SNA CLA
6716  5336     JMP OK       /TAPE UNUSED
6717  1042     TAD PGLAST
6720  7041     CIA
6721  1052     TAD ARG3
6722  7650     SNA CLA
6723  5336     JMP OK       /SAME PROGRAM JUST CALLED FROM TAPE
6724  4422     JMS I MESAGX
6725  1713  TEXT /OK
6726  7700  ?/
6727  6002    IOF
6730  6031     KSF
6731  5330     JMP .-1
6732  6036     KRB
6733  1345     TAD M331     /TYPE Y TO STORE ANYWAY
6734  7640     SZA CLA
6735  5532     JMP I KILALL
6736  4200  OK,JMS CHAIN
6737  1747     TAD I L0PNT
6740  3522     DCA I L0TPNT /SETS LINE0 EXIT
6741  1037  CHWRIT,TAD P20  /WRITE IT
6742  4421     JMS I DTAPX
6743  5341     JMP .-2      /TAPE ERROR
6744  5671     JMP I CHAPUT
              /
6745  7447  M331,-331
6746  0010  P10,10
6747  0540  L0PNT,LINE0
              /
6750  0000  XEND,0
6751  1535    TAD I PGRETN
6752  3052    DCA ARG3
6753  7040    CMA
6754  1135    TAD PGRETN
6755  3135    DCA PGRETN
6756  1535    TAD I PGRETN
6757  3053    DCA ARG4
6760  7040    CMA
6761  1135    TAD PGRETN
6762  3135    DCA PGRETN
```

```
                /
6763  1135      TAD PGRETN
6764  7041      CIA
6765  1372      TAD PZERO
6766  7700      SMA CLA
6767  5222      JMP FIXT        /PGRETN =PZERO;INCREASE IT
6770  5243      JMP CDO
                /
6771  2726    ERRORP,ERR2
6772  7147    PZERO,CHBUFR-1
6773  0022    PCX,PC
6774  0603    MINMAX,-7175
```

(14)

```
/CON0
/A LIST OF CONSTANTS AND ADDRESSES
FIELD 1
KB1=140
FNTABL=6234        /NEW FUNCTION LIST
FNTABF=6346
FNKB1=-6200+600+FNTABL+10
FLETER=FNTABL+10
LISTSM=600                    /FUNCTION LIST
ARG1=50
ARG2=ARG1+1
ARG3=ARG2+1
ARG4=ARG3+1
ARG5=ARG4+1
ARG6=ARG5+1
ARG7=ARG6+1
ARG8=ARG7+1
ARG9=ARG8+1
ARG10=ARG9+1       /(=61)
ARG3H=10
ARG4H=ARG3H+1
ARG5H=ARG4H+1
ARG6H=ARG5H+1
ARG7H=ARG6H+1
ARG8H=ARG7H+1
ARG9H=ARG8H+1
ARG10H=ARG9H+1
/
GETWRX=KB1+1
/
DXS=6057
DXL=6053
DIX=6054
DYS=6067
DYL=6063
MUY=7405
DVI=7407
SHL=7413
ASR=7415
LSR=7417
MQL=7421
MQA=7501
CCEC=6136
CSCF=6133
CCFF=6132
/
MVSTOP=6316
XPOWER=6313        /STOP MICROPHOTOMETER CODES
/
```

(15)

```
                    /FCCAL CONSTANTS
                    XRT2=12
                    TELSW=16
                    LASTV=31
                    T1=32
                    BOTTOM=35
                    T2=71
                    CFRS=133
                    END=134
                    ENDT=135
                    EFUN3I=136
                    CHAR=66
                    COMBUF=132
                    DAXIN=173
                    ERROR2=4566
                    GETC=4545
                    PUSHJ=4540
                    POPJ=5541
                    EFUN=1743
                    EVAL=1613
                    INTEGER=53
                    THISLN=23
                    FINDLN=4555
                    PC=22
                    NAGSW=65
                    PROC=611
                    BUFR=60
                    LINENO=67
                    XRT=11
                    AXOUT=17
                    /
                    F1=5354 /NEW DISPATCHER
                    /
                    LINE0=540
                    LINE1=560
                    LVARIB=3200
                    SPRINT=2600
                    BUFERB=7577
                    /
                    DISCX=20
                    DTAPX=21
                    MESAGX=22
                    *0          /LOADER MISSES FIRST WORD
0000    0000        0
                    *6
0006    5770        CLENGT,-2010
0007    0132        CLOKGO,KILALL
                    *23
0023    0400        DDCORE,400          /INITIAL TEST VALUES
0024    7570        DDWCNT,7570
0025    0000        DISADD,0
0026    0010        DSFELD,0010
0027    0004        DTBLOK,4
0030    0000        DTUNIT,0
0031    0000        TEMPS0,0
0032    7577        M201,-201
0033    0000        BWTEST,0            /PARTIAL DISC BUFFER PROTECT
0034    3200        LASVAR,LVARIB       /HOLDS CURRENT LAST VARIABLE
0035    0044        FLACR,44            /FLAC
0036    5216        BUFEMD,-2562        /-BFTEMP-2010+3:TEXT END
```

```
0037  0020  P20,20
0040  7067  DISEND,-711      /700777 SHOULD BE LAST DISC ADDRESS
0041  0000  DTEST,0
0042  0000  PGLAST,0         /FOR CHAINING
0043  0500  FSDATA,500
0044  3000  FSPROG,3000      /LABL MUST SET THIS TO 160 OR FOCAL FAILS!
            /
            *76
0076  0100  P100,100
0077  7700  M100,-100
            DCSETX=112
            CLKCNT=113
            DISPAX=114      /ENTRY TO LFOC DISPATCH
            GETPRX=115
            BLOCKIN=116
            INTESX=117
            PUTWRX=120
            LINPNT=121
            L0TPNT=122      /POINTS TO TEMP STORE FOR LINE0
            FLAGX=123
            MVBUFX=124
            WAITX=125
            *126
0126  0000  INTRUP,0
            TYPEX=127
            CRLFX=130
            KILALL=132
            FLSETX=133
            NOWNAM=134
            PGRETN=135      /ALSO FOR CHAINING
            OCTPNX=136      /USED TO PRINT CHAIN ADDRESS.
            BWRITX=137
```

File 3 Tape 152
Sept 28/73

(17)

```
 PALP
*OUT-S:CRT
*
*IN-S:CON0,S:GCON,S:CRT1,S:CRT2
*
*
*
*
*OPT-T

ACFULL 6606

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /CRT1
                /LETTERING PROGRAM FOR MEM. SCOPE TYPE 613
                /X STAT(X,Y,S) SETS X,Y ORIGIN
                /SETS CRT OUTPUT FOR +VE X,TELETYPE OUTPUT FOR -VE X
                /S IS LETTER SIZE;   TYPE "C&" TO RESET PAGE
                /
                XTEMP=ARG10
                YTEMP=ARG9
                SCOUN=ARG8
                POINT=ARG7
                COUN12=ARG6
                COUNT7=16
                COUNT5=15
                /
                *KB1+37 /SEE LETPNT
0177   6400     SETCRT
                *FNKB1+37
0703   0734     734      /STAT
                /
                *CRTGOL+600-6200          /IN FUNCTION LIST TABLE
0770   0000     CRTGET,0          /MOVED TO FIELD 0 BY GODO
0771   7450        SNA
0772   1066        TAD CHAR
0773   6213        CDF!CIF 10
0774   4776        JMS I LETSEX
0775   5770     LETBAK,JMP I CRTGET      /RETURN HERE FROM SPRIN
0776   7425     LETSEX,LETSET
                /
                *7425
7425   0000     LETSET,0          /ALWAYS IN CORE
7426   7450        SNA
7427   1234        TAD LETPNT     /JUNK IF NO CODE
7430   3017        DCA 17         /TEMP STORE****
7431   1234        TAD LETPNT
7432   3050        DCA ARG1       /NEEDED TO TEST CRT IN CORE
7433   5514        JMP I DISPAX /ENTRY TO LFOC
7434   0040     LETPNT,40         /SETS KB1+37 FOR LFOC
                /
                *6366
6366   0000     DELAY,0
6367   3051       DCA ARG2       /SAVE AC
6370   1377       TAD M11
6371   3050       DCA ARG1
```

to loc 6370 Field 0

Field 1

```
6372  2050      ISZ ARG1
6373  5372      JMP .-1
6374  1051      TAD ARG2
6375  6054      DIX
6376  5766      JMP I DELAY
                /
6377  7767    M11,-11
                /
                *6400
6400  0000    SETCRT,0
6401  1017        TAD 17        /TEMP STORE****
6402  7440      SZA
6403  4740      JMS I SPRINX /FOCAL LETTER ENTRY
6404  1052      TAD ARG3
6405  7700      SMA CLA
6406  5212      JMP SETOK
6407  1260      TAD PXOUT     /SWITCH TO TTY OUT
6410  6201      CDF
6411  5234      JMP SETGO
6412  1052    SETOK,TAD ARG3
6413  7450      SNA
6414  5221      JMP GO4
6415  3062      DCA XBASE
6416  1062      TAD XBASE
6417  3064      DCA XLOC      /PRESET X POSITION
6420  3072      DCA XMAX
6421  1053    GO4,TAD ARG4
6422  7450      SNA
6423  5227      JMP GO5
6424  3063      DCA YBASE
6425  1063      TAD YBASE
6426  3065      DCA YLOC
6427  1054    GO5,TAD ARG5
6430  7040      CMA
6431  3066      DCA SCALE
6432  4237      JMS TELTST
6433  1255    DOIT,TAD CRTXIT
6434  3657    SETGO,DCA I PRINGO      /CHANGE TYPE OUTPUT
6435  6211      CDF 10
6436  5600      JMP I SETCRT
                /
6437  0000    TELTST,0
6440  6201    TELTRY,CDF
6441  6002      IOF
6442  1656      TAD I TELSWX /TYPING IN PROGRESS?
6443  7650      SNA CLA
6444  5637      JMP I TELTST
6445  6001      ION
6446  5240      JMP TELTRY
                /
                /
                /
6447  4237    ENDIT,JMS TELTST        /SETS DATA FIELD 0!!
6450  1260      TAD PXOUT
6451  3657      DCA I PRINGO          /RESTORE OUTPUT TO TYPER
6452  1262      TAD P277
6453  4527      JMS I TYPEX
6454  5661      JMP I GETOTX
                /
6455  6370    CRTXIT,CRTGOL
```

```
6456  0016  TELSWX,TELSW
6457  0063  PRINGO,OUTDEV
6460  2676  PXOUT,XOUTL      /FOCAL OUT TO TELETYPE
6461  6672  GETOTX,GETOUT
6462  0277  P277,277
            /
6463  0000  DOT,0
6464  1726     TAD I COUN7X /COUNT7
6465  1327     TAD P7
6466  4330     JMS SCALEM
6467  7104     CLL RAL
6470  1065     TAD YLOC
6471  6063     DYL
6472  3060     DCA YTEMP
6473  1064  XSET,TAD XLOC
6474  4725     JMS I SCTESX
6475  6053     DXL
6476  4724     JMS I DELAYX
6477  3061     DCA XTEMP
6500  1066     TAD SCALE
6501  3031  DCA TEMPS0       /COUNTER
6502  1066  YLINE,TAD SCALE
6503  7104     CLL RAL        /DOUBLE Y SCALE
6504  3057     DCA SCOUN
6505  1060     TAD YTEMP
6506  7001  SPREDY,IAC
6507  6063     DYL            /FILL IN YLINE
6510  4724     JMS I DELAYX   /WAIT TILL CRT SETTLES,THEN BRIGHTEN
6511  2057     ISZ SCOUN
6512  5306     JMP SPREDY
6513  7300     CLA CLL
6514  1061     TAD XTEMP
6515  7001     IAC
6516  4725     JMS I SCTESX /TEST EDGR OF SCREEN
6517  6053     DXL
6520  3061     DCA XTEMP
6521  2031     ISZ TEMPS0
6522  5302     JMP YLINE
6523  5663     JMP I DOT
            /
6524  6366  DELAYX,DELAY
6525  6734  SCTESX,SCTEST
6526  0016  COUN7X,COUNT7
6527  0007  P7,7
            /
6530  0000  SCALEM,0
6531  3031     DCA TEMPS0
6532  1066     TAD SCALE
6533  3057     DCA SCOUN
6534  1031     TAD TEMPS0    /MULTIPLY BUT SAVE MQ
6535  2057     ISZ SCOUN
6536  5334     JMP .-2
6537  5730     JMP I SCALEM
            /
6540  6600  SPRINX,SPRIN
            PAUSE/
            /
            /CRT2
            FIELD 1
            /LETTER DECODE AND DISPLAY
```

```
                /
                PAGE
6600  0000      SPRIN,0
6601  1356        TAD P101
6602  7450        SNA
6603  5743        JMP I ENDITX /FOUND ERROR CODE '7677'
6604  1350        TAD M101
6605  0360        AND P377
6606  1351      ACFULL,TAD M246 /&
6607  7450        SNA
6610  5300        JMP SRESET
6611  1354        TAD P6
6612  7500        SMA
6613  5220        JMP LETTER
6614  1355        TAD P23
6615  7650        SNA CLA
6616  5312        JMP CR
6617  5314        JMP LF
                /
6620  7421      LETTER,MQL
6621  7405        MUY
6622  0003        3               /3 WORDS PER CHARACTER
6623  7701        CLA!MQA
6624  1357        TAD LSBASE
6625  3056        DCA POINT       /CHARACTER DESCRIPTOR
6626  1344      INIT,TAD M5
6627  3015        DCA COUNT5
6630  1345        TAD M7
6631  3016        DCA COUNT7
6632  1347      WORDON,TAD M14
6633  3055        DCA COUN12
6634  1456        TAD I POINT
6635  7421        MQL             /DESCRIPTOR WORD
6636  2056        ISZ POINT
6637  7413      BITEST,SHL
6640  0000        0               /SHIFT HIGHEST BIT TO AC
6641  7640        SZA CLA
6642  4676        JMS I DOTEX     /A '1'
6643  2016      TESTON,ISZ COUNT7
6644  5307        JMP TEST12
6645  1066        TAD SCALE       /ONE COLUMN DONE
6646  7041        CIA
6647  1064        TAD XLOC
6650  4334        JMS SCTEST
6651  3064        DCA XLOC
6652  1345        TAD M7
6653  3016        DCA COUNT7
6654  2015        ISZ COUNT5
6655  5307        JMP TEST12
6656  1352      FINISH,TAD P3
6657  4677      EXIT,JMS I SCALEX
6660  1064        TAD XLOC
6661  4334        JMS SCTEST      /AVOID WRAP AROUND
6662  3064      NOWGO,DCA XLOC
6663  1072      NOWGO2,TAD XMAX
6664  7041        CIA
6665  1064        TAD XLOC
6666  7710        SPA CLA
6667  5272        JMP GETOUT
6670  1064        TAD XLOC
```

```
6671  3072      DCA XMAX
6672  6203  GETOUT,CDF!CIF
6673  6001      ION
6674  5675      JMP I LETBAX
6675  6375  LETBAX,LETBAK+6200-600  /ALWAYS RETURN TO FOCAL PRINT
            /
6676  6463  DOTEX,DOT
6677  6530  SCALEX,SCALEM
            /
6700  1063  SRESET,TAD YBASE
6701  3065      DCA YLOC
6702  1354      TAD P6
6703  3062      DCA XBASE
6704  3072      DCA XMAX
6705  1062      TAD XBASE
6706  5262      JMP NOWGO
            /
            /
6707  2055  TEST12,ISZ COUN12
6710  5237      JMP BITEST
6711  5232      JMP WORDON   /12 BIT WORD FINISHED
            /
6712  1062  CR,TAD XBASE
6713  5262      JMP NOWGO
            /
6714  7300  LF,CLA CLL
6715  1346      TAD M24
6716  4677      JMS I SCALEX
6717  1065      TAD YLOC
6720  4334      JMS SCTEST
6721  3065      DCA YLOC
6722  7420      SNL
6723  5263      JMP NOWGO2
6724  1352      TAD P3        /END OF PAGE COLUMN
6725  4677      JMS I SCALEX
6726  1072      TAD XMAX
6727  3062      DCA XBASE
6730  1063      TAD YBASE
6731  3065      DCA YLOC
6732  1062      TAD XBASE
6733  5262      JMP NOWGO
            /
6734  0000  SCTEST,0
6735  7104      CLL RAL
6736  7530      SZL SPA
6737  7340      CLA CLL CMA  /SET 3777 IF >1777
6740  7010      RAR
6741  5734      JMP I SCTEST
            /
6742  0066  CHARAC,CHAR      /FOCAL'S CHARACTER BUFFER
6743  6447  ENDITX,ENDIT
            /
6744  7773  M5,-5
6745  7771  M7,-7
6746  7754  M24,-24
6747  7764  M14,-14
6750  7677  M101,-101
6751  7532  M246,-246
6752  0003  P3,3
6753  0005  P5,5
```

(22)

```
6754  0006  P6,6
6755  0023  P23,23
6756  0101  P101,101
6757  6044  LSBASE,LISLET    /START OF LETTER LIST
6760  0377  P377,377
```

(23)

File 3 Tape 152
Sept 19/73

```
.PALP
*OUT-S:COR
*
*IN-S:CON0,S:COR
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /COR
                /S D=FCOR(XI)  OR FCOR(YI,1)--GIVES CORRECTION IN TENTHS
                /OF A MICRON...XI,YI IN MILLIMETERS
                /
                POINT=ARG10
                *KB1+14
0154    6600    CORRIG
                *FNKB1+14
0660    0012    12      /COR
                /
                *6600
6600    0000    CORRIG,0
6601    1352      TAD ARG3
6602    7427      MQL!DVI       /CORRECTION IS KNOWN FOR EACH 10 MM.
6603    0012    P12,12
6604    7701      CLA!MQA
6605    1226      TAD TABLE
6606    3061      DCA POINT
6607    1461      TAD I POINT
6610    7421      MQL
6611    1353      TAD ARG4
6612    7640      SZA CLA       /ARG4=1 FOR Y
6613    1224      TAD P6        /Y IN LOW PART,SO 12 BIT SHIFT
6614    1223      TAD P5
6615    3217      DCA SHIFT
6616    7413      SHL
6617    0000    SHIFT,0 /GET TOP OR BOTTOM 6 BITS
6620    0225      AND P77
6621    3051      DCA ARG2
6622    5600      JMP I CORRIG
                /
6623    0005    P5,5
6624    0006    P6,6
6625    0077    P77,77
                /
6626    6627    TABLE,.+1       /LIST OF X--Y  CORRECTIONS
6627    0000    0
6630    1010    1010
6631    1310    1010
6632    1210    1210
6633    1212    1212
6634    1212    1212    /FOR 50 MM.
6635    1012    1012
6636    0613    613
6637    0413    413
6640    0414    414
```

```
6641   0413   413      /100
6642   0512   512
6643   0612   612
6644   1012   1012
6645   1111   1111
6646   1211   1211     /150
6647   1211   1211
6650   1210   1210
6651   1112   1112
6652   1212   1212
6653   1212   1212     /200
6654   1212   1212
6655   1211   1211
6656   1112   1112
6657   1212   1212
6660   1212   1212     /250
6661   1311   1311
6662   1311   1311
6663   1212   1212
6664   1112   1112
6665   1011   1011     /300
6666   1011   1011
6667   0710   710
6670   1010   1010
6671   1110   1110
6672   1010   1010     /350
6673   1007   1007
6674   1007   1007
6675   1110   1110
6676   1411   1411
6677   1414   1414     /400
6700   1415   1415
6701   1314   1314
6702   1212   1212
6703   1111   1111
6704   1011   1011     /450
6705   1012   1012
6706   1012   1012
6707   1012   1012
6710   1012   1012     /480--NO  DATA GIVEN PAST 460
```

(25)

File 2 Tape 12H
Jan 13/73

```
.POLP
*OUT-S:DIS
*
*IN-S:CONO,S:DIS
*
*
*OPT-T

ARG1    0050

                /CONO
                XLIST
                PAUSE/
                /
                /DIS
                /XDIS(X,Y) TO PUT A SPOT ON CRT.
                /
                *KB1+36
0176    6100    ONEDIS
                *FNKB1+36
0702    0033    33          /DIS
                /
                *6100
6100    0000    ONEDIS,0
6101    1052      TAD ARG3
6102    6053      DXL
6103    7200      CLA
6104    1053      TAD ARG4
6105    6063      DYL
6106    7200      CLA
6107    6054      DIX
6110    5700      JMP I ONEDIS
                /
```

File 3 Tape 15 C
Sept 28/73

(26)

```
.PALP
*OUT-S:FINK
*
*IN-S:CON0,S:FINK
*
*
*OPT-T

ALIGN  6742

                /CON0
                XLIST
                PAUSE/
                /
                /FINK
                /S  D=FIN(B,I,N) READ SURVEY INPUT
                /1-STAR CODE;2-X INPUT;3-Y INPUT
                /S  D=FOUT(B,I,N) READ AME OUTPUT FROM DISK FILE
                /B-FIRST DISK BLOCK,I-POSITION IN TABLE
                /
                *FNKB1+42
0706  3426    3426      /IN
0707  1474    1474      /OUT
                *KB1+42
0202  6741    IN
0203  6774    OUT
                /
                *6737
6737  0013    P13,13    /11*2+2+16=40
6740  0000    TEMP,0
                /
6741  0000    IN,0
6742  1053    ALIGN,TAD ARG4
6743  1032      TAD M201
6744  7510      SPA
6745  5353      JMP GO
6746  3053      DCA ARG4        /AVOID OVERFLOW FOR LARGE ARG4
6747  1037      TAD P20
6750  1052      TAD ARG3
6751  3052      DCA ARG3        /16 BLOCKS FOR 129 IMAGES
6752  5342      JMP ALIGN
6753  7300    GO,CLA CLL
6754  1053      TAD ARG4
6755  7425      MQL!MUY
6756  0010      10
6757  7501      MQA
6760  1337    DOIT,TAD P13      /FIRST 40 WORDS RESERVED
6761  1054      TAD ARG5        /DATA ARE IN SEQUENCE
6762  7004      RAL             /2 12 BIT WORDS PER DATUM
6763  3053      DCA ARG4        /ADDRESS FOR GETWRD
6764  4541      JMS I GETWRX
6765  1051      TAD ARG2
6766  3340      DCA TEMP
6767  2053      ISZ ARG4        /FOR NEXT WORD
6770  4541      JMS I GETWRX
6771  1340      TAD TEMP
6772  3050      DCA ARG1        /HI ORDER FIRST
6773  5741      JMP I IN
                /
6774  0000    OUT,0
```

(27)

```
6775  1374      TAD OUT
6776  3341      DCA IN
6777  5342      JMP ALIGN
```

Tape 15C
File 3 - Apr 74.

```
                    /
                    /GCON
                    /
                    XJOY=6363          /IOT FOR JOYSTICK
                    YJOY=6364
                    SKPJOY=6365
                    CODLOD=6361
                    READSW=6362
                    /
                    SETSUR=6733
                    REDSUR=6737
                    AMEG01=6724
                    SETAME=6723
                    MOVAME=6733
                    READAM=6727
                    ARESET=6725
                    SKIPAM=6722
                    /
                    *62
0062  0000          XBASE,0
0063  0000          YBASE,0
0064  0000          XLOC,0
0065  0000          YLOC,0
0066  0000          SCALE,0
                    *71
0071  0000          SIGN,0
0072  0000          XMAX,0   /NOTE SAME AS XCON,NOT AS MCON
                    /
                    FINDX=104
                    LOCX=105
                    READAX=106
                    ALOCX=107
                    COMNDX=110
                    BCDBNX=111
                    /
                    CRTGOL=6370        /NEEDED FOR 'CRT'
                    OUTDEV=63
                    XOUTL=2676
                    TELSW=16
                    LISLET=6044        /POINTERS TO FOCAL AND LIST
```

Jan 27/72.

```
.PALP
*OUT-S:GOTO
*
*IN-S:CON0,S:GOTO
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /GOTO
                /X GO(S,L) WILL START SUBROUTINE
                /S AT L;X DO(S,L) WILL DO A LINE OR SUBROUTINE.
                /
                *KB1+56
0216    6200    GOTO
0217    6223    DO
                *FNKB1+56
0722    3407    3407    /GO
0723    3357    3357    /DO
                /
                *6200
6200    0000    GOTO,0
6201    1227      TAD P604
6202    7421    SETIT,MQL
6203    1052      TAD ARG3
6204    7106      CLL RTL
6205    7006      RTL
6206    7006      RTL
6207    7004      RAL
6210    6201      CDF
6211    1053      TAD ARG4
6212    3630      DCA I LINENX
6213    1053      TAD ARG4
6214    7640      SZA CLA
6215    7130      STL RAR           /SET FOR ONE LINE(4000)
6216    3631      DCA I NAGSWX      /0 FOR GROUP
6217    6203      CDF!CIF
6220    7501      MQA               /GET ENTRY ADDRESS
6221    5622      JMP I .+1
6222    1553      GOPUSH
                /
6223    0000    DO,0
6224    1226      TAD P421
6225    5202      JMP SETIT         /RETURN IS VIA 'EXIT'
                /
6226    0421    P421,421          /ENTRY TO DO ROUTINE
6227    0604    P604,604          /ENTRY TO GO ROUTINE
6230    0067    LINENX,LINEN0
6231    0065    NAGSWX,NAGSW
                /
                FIELD 0
                *1553   /THIS IS LOADED TO STEN AND STAR.
1553    3357    GOPUSH,DCA GODO
1554    6001      ION
1555    4545      GETC  /BYPASS ')'
```

```
1556   4540     PUSHJ
1557   0000   GODO,0   /421 OR 604
1560   5761   EXIT, JMP I .+1
1561   0273     273    /THIS SEEMS TO CARRY ON CLEANLY(INPUTX+2)
```

IBM TAPE PROGRAM

The IBM handler program is somewhat different for AME data than for Image Scanner data. The scanner produces blocks of 512 lower precision words, then 512 upper precision words. When writing tape, these are rearranged in core to have each upper precision word followed by its own lower precision word. Data for the AME is already arranged in proper sequence, and no rearranging is necessary.

Scanner Commands

READ WRIT

AME Commands

IBMR IBMW

all others are the same.

(31B)

IBM.

```
 L
/
/
/ICON-CONSTANTS FOR IBM TAPE
XLIST
/
IBSTAR=6701
IBSTOP=6702
IBSET=6703
IBSTAT=6704      /STATUS TO AC
SKWAIT=6705
SKFILE=6706      /SKIP TESTS
SKNCOD=6707
/
BUFR=14 /AUTO INDEX
COUNTR=ARG10
STASAV=ARG9
MERCNT=ARG10H
/
MVBAK1=6177
BAK1=6176
MVFOR1=6175
/
WAIT2=6377
GAPWT2=6376
BFSET2=6375
BOTES2=6374
/
WAIT3=6577
GAPWT3=6576
BFSET3=6575
MVBAK3=6574
MVFOR3=6573
/
XLIST
PAUSE

*
```

KB1+:	Command
66	~~Rewd~~ IBMR
67	BAK
70	ADV
71	IBMI
72	IBME
73	WRIT
74	EOF
75	RWND
76	HUNT
77 -	ReVM

(32)

June 15/73
For Scanner Dat

```
*OUT-S:IBM1
*
*IN-S:CON0,S:ICON,S:IBM1
*
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /ICON-CONSTANTS FOR IBM TAPE
                XLIST
                PAUSE/
                /
                /IBM1-WAIT,STATUS,DELAYS
                /X READ OR WRITE(B,W,N,I) N WORDS STARTING AT DISC BLOCK B
                /WORD W. DOUBLE PRECISION IF I IS ZERO.
                /S D=FIBM(M) GIVES STATUS,MASKED BY M,UNLESS M=0.
                /X IBME(0) ERASES 4 FEET OF TAPE.
                /EACH OPERATION STARTS BY TESTING WAIT,THEN 36 MSEC DELAY.
                /X HUNT(0)-LOOKS FOR DOUBLE END OF FILE.
                /
                *KB1+71
 0231   6105    STATUS
 0232   6121    ERASIM
                *KB1+75
 0235   6140    REWIND
 0236   6150    HUNT
                *FNKB1+75
 0741   0364    364         /RWND
 0742   2204    2204        /HUNT
                *FNKB1+71
 0735   0435    435         /IBM
 0736   0655    655         /IBME
                /
                *WAIT2
 6377   6042    WAIT
                *WAIT3
 6577   6042    WAIT
                *BOTES2
 6374   6162    BOTEST
                /
                *6042
                /
 6042   0000    WAIT,0  /TEST WAIT FLAG
 6043   4267      JMS DELY36
 6044   6704    LINTES,IBSTAT
 6045   0320      AND P10
 6046   7650      SNA CLA
 6047   5260      JMP ONLINE
 6050   4422      JMS I MESAGX
 6051   1706    TEXT /OF
 6052   0640    F
 6053   1411    LI
 6054   1605    NE
 6055   0000    /
```

```
6056  4876    JMS SECOND
6057  5244    JMP LINTES
              /
6060  6704  ONLINE,IBSTAT
6061  0317    AND P400
6062  7650    SNA CLA
6063  5260    JMP ONLINE      /REWINDING
6064  6705  TRY,SKWAIT
6065  5642    JMP I WAIT      /'WAIT' FLAG OFF.
6066  5264    JMP TRY
              /
6067  0000  DELY36,0          /36 MSEC DELAY
6070  3016    DCA 16          /COUNTER
6071  1671    TAD I .         /4.5 MICROSEC.DELAY
6072  2016    ISZ 16
6073  5271    JMP .-2
6074  7300    CLA CLL
6075  5667    JMP I DELY36
              /
6076  0000  SECOND,0          /2 SECOND DELAY
6077  1077    TAD M100
6100  3017    DCA 17
6101  4267    JMS DELY36
6102  2017    ISZ 17
6103  5301    JMP .-2
6104  5676    JMP I SECOND
              /
              /
6105  0000  STATUS,0
6106  6704    IBSTAT
6107  7040    CMA   /ALL BITS ARE COMPLEMENTED IN HARDWARE.
6110  3051    DCA ARG2
6111  1052    TAD ARG3
6112  7450    SNA
6113  5705    JMP I STATUS
6114  0051    AND ARG2
6115  3051    DCA ARG2        /MASK STATUS WITH ARG3
6116  5705    JMP I STATUS
              /
              /
6117  0400  P400,400
6120  0010  P10,10
              /
6121  0000  ERASIM,0
6122  4242    JMS WAIT
6123  6704    IBSTAT
6124  7006    RTL
6125  7700    SMA CLA
6126  5532    JMP I KILALL    /WRITE PROTECTED.
6127  1337    TAD ERASER
6130  6703    IBSET
6131  6701    IBSTAR
6132  7200    CLA
6133  4276    JMS SECOND
6134  6702    IBSTOP
6135  4776    JMS I BAK1      /MOVE BACK PAST GAP MARK.
6136  5721    JMP I ERASIM
              /
6137  6357  ERASER,6357       /MOVE FORWARD ERASING.
              /
```

```
6140  0000  REWIND,0
6141  4242    JMS WAIT
6142  1347    TAD CREWND
6143  6703    IBSET
6144  6701    IBSTAR
6145  7300    CLA CLL
6146  5740    JMP I REWIND
              /
6147  7677  CREWND,7677
              /
6150  0000  HUNT,0
6151  4775  SEARCH,JMS I MVFOR1      /MOVE PAST 1 RECORD
6152  6706    SKFILE
6153  5351    JMP SEARCH     /PASSED 4095 RECORDS-NO FILE
6154  4775    JMS I MVFOR1
6155  6706    SKFILE
6156  5351    JMP SEARCH     /NOT A DOUBLE FILE END.
6157  5750    JMP I HUNT
              /
6160  7373  CMOVEF,7373      /STOP FOR A GAP
6161  0200  P200,200
              /
6162  0000  BOTEST,0         /TEST FOR BOT
6163  6704  BTEST,IBSTAT
6164  0361    AND P200
6165  7640    SZA CLA
6166  5762    JMP I BOTEST
6167  1360    TAD CMOVEF
6170  6703    IBSET
6171  6701    IBSTAR
6172  7300    CLA CLL
6173  5363    JMP BTEST      /MOVE OFF B.O.T.
```

```
.PALP
*OUT-S:IBMB
*
*IN-S:CON0,S:ICON,S:IBMB
*
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /ICON-CONSTANTS FOR IBM TAPE
                XLIST
                PAUSE/
                /
                /IBMR--READ IBM
                /SET D=&IBMR(B,W,N,P,S3,Q,D -VEIF TAPE ERROB PERCISTS,BUD
                /READS ANYWAY! P FOR SINGLE PRECISION,S3 FOB 3BYTE,Q=NODISK
                /S D=FBAK(N,J)FADV(N,J).MOVE N RECORDS.;PASTEOF UNLESS J=0
                /D IS BAD RECORD COUNT.
                /
                *MVBAK1
6177    6255    MVBAKR
                *MVBAK3
6574    6255    MVBAKR
                *MVFOR1
6175    6333    MVFORC
                *MVFOR3
6573    6333    MVFORC
                /
                *KB1+66
0226    6200    IBREAD
0227    6326    MOVBAK
0230    6275    MOVFOR
                *FNKB1+66
0732    0672    672     /IBMR
0733    3523    3523    /BAK
0734    3466    3466    /ADV
                /
                *6200
6200    0000    IBREAD,0
6201    1252    IRNEXT,TAD M3
6202    3253      DCA ERRCNT
6203    5205      JMP TRY1
6204    4255    TRYRED,JMS MVBAKR
6205    4777    TRY1,JMC I WAIT2
6206    4774      JMS I BOTES2  /MOVE OFF BOT
6207    1350      TAD P2        /OFFSET FOR 1ST 24 BYTES IN 4 BYTE
6210    4775      JMS I BFSET2
6211    1056      TAD ARG7
6212    7650      SNA CLA
6213    1351      TAD P10       /4 BYTE MODE
6214    1254      TAD CREAD     /STOP ON GAP
6215    6703      IBSET
6216    6701      IBSTAR
6217    7300      CLA CLL
6220    4776      JMS I GAPWT2  /WAIT FOR GAP
```

In AME (35)

File 3 Tape 15 A
June 21/23

use IBM1, IBMB
IBMe, IBMD
for double precision
accum to disc..

```
6221  1060     TAD STASAV
6222  7700     SMA CLA
6223  5226     JMP DATSAV     /NO READ ERROR
6224  2253     ISZ ERRCNT
6225  5204     JMP TRYRED
6226  6706   DATSAV, SKFILE
6227  5232     JMP NOFILE
6230  3060     DCA STASAV     /0 FOR FILE END
6231  5246     JMP REXIT
6232  2060   NOFILE, ISZ STASAV        /4096 FOR NORMAL READ
6233  1057     TAD ARG8
6234  7640     SZA CLA
6235  5246     JMP REXIT      /NO DISC XFER
6236  4775     JMS I BFSET2
6237  1414   PUSH, TAD I BUFR
6240  3051     DCA ARG2
6241  4520     JMS I PUTWRX
6242  3052     DCA ARG3       /USE SUCCESIVE DISK WORDS
6243  3053     DCA ARG4
6244  2061     ISZ COUNTR
6245  5237     JMP PUSH       /PUT DATA ON DISC
6246  1060   REXIT, TAD STASAV
6247  3050     DCA ARG1
6250  3051     DCA ARG2
6251  5600     JMP I IBREAD
               /
               /
6252  7775   M3, -3
6253  0000   ERRCNT0
6254  7323   CREAD, 7323          /READ FWRD, STOP ON GAP. 7333 FOR 4 BYTE.
               /
6255  0000   MVBAKR, 0            /MOVE BACK ONE RECORD.
6256  4777     JMS I WAIT2
6257  1274     TAD BMOVGS     /STOP ON GAP
6260  6703     IBSET
6261  6701     IBSTAR
6262  7300     CLA CLL
6263  4776     JMS I GAPWT2   /NOW READ REAL GAP
6264  6706     SKFILE
6265  5655     JMP I MVBAKR
6266  4777   BEXIT, JMS I WAIT2        /FILE MARK FOUND MOVING BACK
6267  1053     TAD ARG4
6270  7650     SNA CLA        /ARG4=1 TO BACK OVER FILEEND.
6271  4333     JMS MVFORC     /MOVE UP PAST FILE MARK
6272  5655     JMP I MVBAKR
               /
6273  0040   P40, 40
6274  7573   BMOVGS, 7573         /STOP ON GAP
               /
6275  0000   MOVFOR, 0            /MOVE ARG3 RECORDS
6276  1345     TAD FORWRD
6277  3344   SETMOV, DCA DIREC
6300  3017     DCA MERCNT
6301  1052     TAD ARG3
6302  7450     SNA
6303  5675     JMP I MOVFOR   /IGNORE ADV(0)
6304  7041     CIA
6305  3052     DCA ARG3
6306  4744   FMOVE, JMS I DIREC        /CAN BE MVFORCMVBAKR
6307  6706     SKFILE
```

```
6310  7410    SKP
6311  5322    JMP FILEND      /FILE FOUND
6312  1060  GOON, TAD STASAV
6313  7710    SPA CLA
6314  2017    ISZ MERCNT      /COUNT BAD RECORDS
6315  2052    ISZ ARG3
6316  5306    JMP FMOVE
6317  1017  EXIT, TAD MERCNT
6320  3051    DCA ARG2
6321  5675    JMP I MOVFOR
6322  1053  FILEND, TAD ARG4
6323  7650    SNA CLA
6324  5317    JMP EXIT
6325  5312    JMP GOON
              /
6326  0000  MOVBAK, 0
6327  1326    TAD MOVBAK
6330  3275    DCA MOVFOR
6331  1346    TAD BACKWD
6332  5277    JMP SETMOV
              /
6333  0000  MVFORC0          /FORWARD 1 RECORD
6334  4777    JMS I WAIT2
6335  4774    JMS I BOTES2    /MOVE OFF BOT
6336  1352    TAD CMOVEF
6337  6703    IBSET
6340  6701    IBSTAR
6341  7300    CLA CLL
6342  4776    JMS I GAPWT2
6343  5733    JMP I MVFORC
              /
6344  0000  DIREC, 0
6345  6333  FORWRD, MVFORC
6346  6255  BACKWD, MVBAKR
              /
6347  0040  PP40, 40
6350  0002  P2, 2
6351  0010  P10, 10
6352  7373  CMOVEF, 7373      /STOP FOR GAP
```

```
      .PALP
      *OUT-S:IBMC
      *
      *IN-S:CON0,S:ICON,S:IBMC
      *
      *
      *
      *OPT-T

      ARG1    0050

                        /CON0
                        XLIST
                        PAUSE/
                        /
                        /ICON-CONSTANTS FOR IBM TAPE
                        XLIST
                        PAUSE/
                        /
                        /IBMC-WRITE TAPE
                        /S D=FIBMW(B,W,N,P,Q).ERASED SEGMEND COUNT=D
                        /B FIRST BLOCK,W FIRST WORD,Q-IGNORE DISC.P-SINGLE PRECISIO
                        /
                        *BAK1
      6176    6537      BAK
                        /
                        *KB1+73
      0233    6400      BWRITE
      0234    6510      ENFILE
                        *FNKB1+73
      0737    0677      677
      0740    0176      176       /EOF
                        /
                        *6400
      6400    0000    BWRITE,0
      6401    3017      DCA MERCNT
      6402    4320      JMS WRTEST      /WRITE PROTECT TEST.
      6403    4775    WRITGO,JMS I BFSET3
      6404    1056      TAD ARG7
      6405    7640      SZA CLA
      6406    5216      JMP NOWGO       /IGNORE DISC FOR Q!
      6407    4541    GETNEX,JMS I GETWRX
      6410    3052      DCA ARG3
      6411    3053      DCA ARG4        /SUCCESIVE WORDS
      6412    1051      TAD ARG2
      6413    3414      DCA I BUFR
      6414    2061      ISZ COUNTR
      6415    5207      JMP GETNEX
      6416    1707    NOWGO,TAD I WRD7          /FIRST DATA WORD
      6417    7415      ASR
      6420    0013      13                /GET SIGN
      6421    0304      AND P377
      6422    3706      DCA I WRD6
      6423    3705      DCA I WRD5      /PART OF IBM PREAMBLE-0 FOR SINGLE RECORD.
      6424    4777    REPEAT,JMS I WAIT3
      6425    1274      TAD CWRITE
      6426    6703      IBSET
      6427    7200      CLA
      6430    6701      IBSTAR
      6431    6201      CDF
      6432    1700    WTEST,TAD I IBMWC
```

```
6433  7640     SZA CLA
6434  [illegible]  JMP WTEST      /WAIT TILL ALL DATA XFERRED.
6435  6211     CDF 10
6436  4776     JMS I GAPWT3   /WAIT TILL GAP PASSES READ HEAD.
6437  6702     IBSTOP
6440  1017     TAD MERCNT
6441  3051     DCA ARG2       /TELL FOCAL ABOUT ERASED SPOTS.
6442  1060     TAD STASAV
6443  7700     SMA CLA
6444  5600     JMP I BWRITE
6445  4777     JMS I WAIT3
6446  4775  WERROR,JMS I BFSET3      /SET COUNTR
6447  1276     TAD CMOVEB
6450  2017     ISZ MERCNT     /COUNT ERRORS
6451  6703     IBSET
6452  6701     IBSTAR
6453  7300  BAKING,CLA CLL
6454  1301     TAD M4         /BACK OVER A MEASURED SPACE
6455  4326     JMS SPACER
6456  2061     ISZ COUNTR
6457  5253     JMP BAKING
6460  1303     TAD M500
6461  4326     JMS SPACER     /ALLOW FOR PART OF GAP
6462  6702     IBSTOP
6463  4777  MOVOUT,JMS I WAIT3
6464  4775     JMS I BFSET3
6465  1275     TAD ERAS
6466  6703     IBSET          /ERASE CURRENT RECORD
6467  7300     CLA CLL
6470  6701     IBSTAR
6471  4326     JMS SPACER     /ERASE 1024
                                    4 BYTE RECORD
6472  4775     JMS I BFSET3   /ERAS TOOK 1 WORD FROM CORE
6473  5224     JMP REPEAT     /TRY TO REWRITE IT
               /
6474  1357  CWRITE,1357      /IBM UNFORMAT,NO STOP ON GAP!
6475  6357  ERAS,6357
6476  7577  CMOVEB,7577      /CAN NOT MOVE BACK WRITING!
6477  7351  CENDF1,7351
6500  7752  IBMWC,7752
6501  7774  M4,-4
6502  0040  P40,40
6503  7300  M500,-500
6504  0377  P377,377
6505  2576  WRD5,2576
6506  2577  WRD6,2577
6507  2600  WRD7,2600
               /
               /
6510  0000  ENFILE,0
6511  4777     JMS I WAIT3
6512  4320     JMS WRTEST     /TEST WRITE PROTECT OFF.
6513  1277     TAD CENDF1
6514  6703     IBSET
6515  6701     IBSTAR
6516  7300     CLA CLL
6517  5710     JMP I ENFILE   /END FILE STARTED.
               /
6520  0000  WRTEST,0
6521  6704     IBSTAT
6522  7006     RTL
```

```
6523  7700    SMA CLA
6524  5532    JMP I KILALL  /TRIED TO WRITE WITHOUT RING.
6525  5720    JMP I WRTEST
              /
6526  0000  SPACER,0
6527  3016    DCA 16
6530  6704  STEP,IBSTAT      /CLEAR ENCODER FF.
6531  6707    SKNCOD
6532  5331    JMP .-1
6533  2016    ISZ 16
6534  5330    JMP STEP
6535  7300    CLA CLL
6536  5726    JMP I SPACER
              /
6537  0000  BAK,0
6540  4774    JMS I MVBAK3  /FIND THE GAP MARK
6541  4777    JMS I WAIT3   /DELAY NEEDED AFTER NEGATING A MOTION
6542  1276    TAD CMOVEB
6543  6703    IBSET
6544  6701    IBSTAR        /MOVE GAP PAST WRITE HEAD
6545  7300    CLA CLL
6546  4777    JMS I WAIT3
6547  6702    IBSTOP
6550  5737    JMP I BAK
```

```
.PALP
*OUT-S:IBMD
*
*IN-S:CON0,S:ICON,S:IBMD
*
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /ICON-CONSTANDS FOR IBM TAPE
                XLIST
                PAUSE/
                /
                /IBMD-WAIT FOR GAP
                /SET BUFFER POINTERS
                /
                *GAPWT2
6376    6600    GAPWIT
                *GAPWT3
6576    6600    GAPWIT
                *BFSET2
6375    6632    BFSET
                *BFSET3
6575    6632    BFSET
                /
                *6600
6600    0000    GAPWIT,0
6601    6704    GWAIT,IBSTAT
6602    0230      AND PP200
6603    7650      SNA CLA
6604    5600      JMP I GAPWIT  /B.O.T.
6605    6704      IBSTAT
6606    0231      AND PP40
6607    7640      SZA CLA
6610    5201      JMP GWAIT     /WAIT FOR GAP
6611    6704      IBSTAT
6612    0037      AND P20
6613    7650      SNA CLA
6614    7144      CMA CLL RAL   /ERROR
6615    3060      DCA STASAV
6616    6704    GAPEND,IBSTAT
6617    0231      AND PP40
6620    7650      SNA CLA
6621    5216      JMP GAPEND    /WAIT TILL GAP PULSE DONE
6622    6706      SKFILE
6623    5600      JMP I GAPWIT
6624    4422      JMS I MESAGX
6625    0517    TEXT /EO
6626    0600    F/
6627    5600      JMP I GAPWIT
              /
6630    0200    PP200,200
6631    0040    PP40,40
                /
6632    0000    BFSET,0
```

```
6633  6201    CDF
6634  1302    TAD WRD0
6635  3713    DCA I IBMCA
6636  1307    TAD WRD6        /PREPARE PREAMBLE
6637  3014    DCA BUFR
6640  1054    TAD ARG5
6641  7450    SNA
6642  1314    TAD P1004       /516 WORDS NORMALLY
6643  3054    DCA ARG5
6644  1054    TAD ARG5
6645  7104    CLL RAL         /2 PDP WORDS PER WORD
6646  7041    CIA
6647  3061    DCA COUNTR
6650  1061    TAD COUNTR
6651  1311    TAD M6          /6 WORDS OF PREAMBLE TO WRITE
6652  3712    DCA I IBMWC
6653  6211    CDF 10
6654  1054    TAD ARG5
6655  1315    TAD M1100
6656  7700    SMA CLA
6657  5532    JMP I KILALL    /TOO LONG
6660  7001    IAC             /DATA BYTES+4 TO BYTE 6
6661  1054    TAD ARG5
6662  7421    MQL
6663  7413    SHL
6664  0001    1
6665  3705    DCA I WRD3      /FIRST 24 BYTES IN 3 BYTE MODE
6666  7501    MQA             /(WRITE ONLY)
6667  3706    DCA I WRD4
6670  1706    TAD I WRD4
6671  1310    TAD P4          /DATA BYTES +8 TO BYTE 2(AND 1)
6672  7421    MQL
6673  1705    TAD I WRD3
6674  7413    SHL
6675  0007    7
6676  3703    DCA I WRD1
6677  7501    MQA
6700  3704    DCA I WRD2
6701  5632    JMP I BFSET
                /
6702  2571  WRD0,2571
6703  2572  WRD1,2572
6704  2573  WRD2,2573
6705  2574  WRD3,2574
6706  2575  WRD4,2575
6707  2577  WRD6,2577
6710  0004  P4,4
6711  7772  M6,-6
6712  7752  IBMWC,7752
6713  7753  IBMCA,7753
6714  1004  P1004,1004
6715  6700  M1100,-1100
```

Tape 152 File 3
Sept 5/73

```
.PALP
*OUT-S:JOY
*
*IN-S:CON0,S:CCON,S:JOY
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /CCON
                XLIST
                PAUSE/
                /
                /JOY
                /X JOY(0) MOVE AME STAGE WITH JOYSTICK
                /MUST BE IN OVERLAY WITH 'STEP'
                /
                STEPX=KB1+13    /'STEP'
                /
                *FNKB1+5
0651  0721      721       /JOY
                *KB1+5
0145  6650      STAGE
                /
                *6650
6650  0000      STAGE,0
6651  1337      SWTEST,TAD P3
6652  6361        CODLOD
6653  7200        CLA
6654  6362        READSW
6655  0340        AND P2000       /SWITCH 3,11
6656  7640        SZA CLA
6657  5650        JMP I STAGE
6660  1037      REPEAT,TAD P20
6661  6361        CODLOD
6662  7200        CLA
6663  6363        XJOY
6664  4344        JMS MOVER
6665  3054        DCA ARG5        /X SPEED
6666  7501        MQA
6667  7040        CMA             /SO MOTION ON TV AGREES
6670  3010        DCA ARG3H
6671  7501        MQA
6672  7700        SMA CLA
6673  7344        CLA CLL CMA RAL         /-2
6674  7001        IAC
6675  3052        DCA ARG3        /X DIRECTION
6676  6364      YJOY
6677  4344        JMS MOVER
6700  3055        DCA ARG6        /Y SPEED&PULSE WIDTH)
6701  7501        MQA
6702  3011        DCA ARG4H
6703  7501        MQA
6704  7710        SPA CLA
6705  7344      CLA CLL CMA RAL
6706  7001        IAC
```

```
6707  3053      DCA ARG4        /Y DIRECTION
6710  1337      TAD P3
6711  6361      CODLOD
6712  7200      CLA
6713  6362      READSW
6714  7700      SMA CLA         /TEST SWITCH 3,12
6715  5330      JMP GO
6716  1054      TAD ARG5
6717  0342      AND P7760       /IGNORE SMALL SIGNALS
6720  7440      SZA
6721  7240      CLA CMA
6722  3054      DCA ARG5
6723  1055      TAD ARG6
6724  0342      AND P7760
6725  7440      SZA
6726  7240      CLA CMA
6727  3055      DCA ARG6        /SET HI SPEED DRIVE
6730  1054  GO, TAD ARG5
6731  1055      TAD ARG6
6732  7004      RAL
6733  1076      TAD P100        /PULSE PERIOD
6734  3056      DCA ARG7
6735  4553      JMS I STEPX
6736  5251      JMP SWTEST
                /
6737  0003  P3, 3
6740  2000  P2000, 2000
6741  7760  M20, -20
6742  7760  P7760, 7760
6743  0000  TEMP, 0
                /
6744  0000  MOVER, 0
6745  7001      IAC
6746  6365      SKPJOY
6747  5345      JMP .-2
6750  1341      TAD M20
6751  7040      CMA             /SO MOTION ON TV AGREES WITH STICK
6752  3343      DCA TEMP
6753  1343      TAD TEMP
6754  7710      SPA CLA
6755  7040      CMA
6756  7421      MQL             /SIGN FOR DRIVER
6757  1343      TAD TEMP
6760  7510      SPA
6761  7040      CMA
6762  7106      CLL RTL
6763  7000      OPR   /FOR TEST
6764  5744      JMP I MOVER
```

(45)

File 3 Tape 15C
Mar. 5/74.

```
.PALP
*OUT-S:LABL
*
*IN-S:CON0,S:GCON,S:LABL
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /MAR.4/74.
                FIELD 1
                *550
0550   4001     4001       / A
0551   1505     1505       /ME
0552   6764     6764       /74
0553   5504     5504       /-D
                /
                *DISEND
0040   7067     -711       /END OF DISC DATA AREA
                *FSDATA
0043   0500     500        /FIRST DATA BLOCK
                *FSPROG
0044   0160     160        /FIRST PROG. BLOCK
                *7371
7371   7240     CLA CMA
7372   6733     6733               /STOP CARRIAGE MOTION
                /
                /LOAD OVER GFOC TO LABEL NEW VERSION.
                /AND TO PRESET DISC AND TAPE CONSTANTS

.
```

(46)

Nov. 27/72

```
.PALP
*OUT-S:LIST
*
*IN-S:MCON,S:LIST
*
*
*OPT-T

ADCV    6532

                /
                /
                /MCON
                XLIST
                PAUSE/
                /
                /LIST=LIST OF CHARACTER CODES FOR CRT LETTERING
                /
                FIELD 1
                *LISLET
6044    0000    SPACE,0
6045    0000    0
6046    0000    0
6047    0000    0
6050    1170    1170
6051    0000    0           /!=241
6052    0001    0001
6053    6000    6000
6054    3400    3400        /"
6055    1237    1237
6056    6247    6247
6057    7450    7450        /#
6060    2322    2322
6061    3774    3774
6062    4542    4542        /$
6063    4154    4154
6064    6106    6106
6065    3302    3302        /%
6066    0000    0
6067    0000    0
6070    0000    0
6071    0000    0000
6072    0070    0070
6073    0000    0000        /'
6074    1610    1610
6075    5014    5014
6076    0400    0400        /(
6077    0020    0020
6100    3012    3012
6101    1070    1070        /)
6102    0412    0412
6103    4342    4342
6104    5020    5020        /*
6105    0402    0402
6106    0760    0760
6107    4020    4020        /+
6110    0020    0020
6111    1603    1603
6112    4000    4000
6113    0002    0002
```

```
6114  0100  0100
6115  4020  4020    /-
6116  0030  0030
6117  1400  1400
6120  0000  0000    /.
6121  6016  6016
6122  0160  0160
6123  1400  1400    / /=257
                    /
6124  3724  3724
6125  3114  3114
6126  2574  2574    /0
6127  0020  0020
6130  5774  5774
6131  0000  0000    /1
6132  4130  4130
6133  3214  3214
6134  4614  4614    /2
6135  2120  2120
6136  3114  3114
6137  4554  4554    /3
6140  1405  1405
6141  0227  0227
6142  7440  7440    /4
6143  2361  2361
6144  3052  3052
6145  2461  2461    /5
6146  3722  3722
6147  3114  3114
6150  4540  4540    /6
6151  0070  0070
6152  2710  2710
6153  6406  6406    /7
6154  3322  3322
6155  3114  3114
6156  4554  4554    /8
6157  0322  0322
6160  3114  3114
6161  4574  4574    /9
                    /
6162  0000  0000
6163  0241  0241
6164  2000  2000    /:
6165  4031  4031
6166  0640  0640
6167  0000  0000    /;
6170  0405  0405
6171  0424  0424
6172  0400  0400    /<
6173  0005  0005
6174  0241  0241
6175  2050  2050    /=
6176  0020  0020
6177  2421  2421
6200  2020  2020    />
6201  0100  0100
6202  3310  3310
6203  4414  4414    /?
6204  0000  0
6205  0000  0
```

```
6206  0000  0       /0
                /
6207  7604  7604
6210  4211  4211
6211  1370  1370    /A
6212  7762  7762
6213  3114  3114
6214  4554  4554    /B
6215  3720  3720
6216  3014  3014
6217  0504  0504    /C
6220  7760  7760
6221  3012  3012
6222  1070  1070    /D
6223  7762  7762
6224  3114  3114
6225  0602  0602    /E
6226  7742  7742
6227  2110  2110
6230  0402  0402    /F
6231  3720  3720
6232  3215  3215
6233  0504  0504    /G
6234  7742  7742
6235  0100  0100
6236  4376  4376    /H
6237  0020  0020
6240  3774  3774
6241  0400  0400    /I
6242  1010  1010
6243  1002  1002
6244  0076  0076    /J
6245  7743  7743
6246  0222  0222
6247  0600  0600    /K
6250  7760  7760
6251  1004  1004
6252  0200  0200    /L
6253  7741  7741
6254  4300  4300
6255  3376  3376    /M
6256  7741  7741
6257  4103  4103
6260  0376  0376    /N
6261  3720  3720
6262  3014  3014
6263  0574  0574    /O
6264  7742  7742
6265  2110  2110
6266  4414  4414    /P
6267  3720  3720
6270  3216  3216
6271  0774  0774    /Q
6272  7742  7742
6273  2312  2312
6274  4614  4614    /R
6275  6322  6322
6276  3114  3114
6277  4546  4546    /S
6300  0040  0040
```

```
6301   3770   3770
6302   0402   0402     /T
6303   3760   3760
6304   1004   1004
6305   0176   0176     /U
6306   0754   0754
6307   1003   1003
6310   0036   0036     /V
6311   7754   7754
6312   0143   0143
6313   0376   0376     /W
6314   6145   6145
6315   0101   0101
6316   2306   2306     /X
6317   0141   0141
6320   1700   1700
6321   2006   2006     /Y
6322   6066   6066
6323   3114   3114
6324   6606   6606     /Z
                /
6325   7760   7760
6326   3010   3010
6327   0000   0000     /SQUARE OPEN BRACKET
6330   0041   0041
6331   6347   6347
6332   4200   4200     /BACK SLASH
6333   0000   0000
6334   1030   1030
6335   0776   0776     /SQUARE CLOSE BRACKET
6336   0200   0200
6337   5770   5770
6340   1010   1010     /↑
6341   0407   0407
6342   0520   0520
6343   4020   4020     /BACK ARROW
```

Nov 8/73
File 3 Tape 15 B

(50)

```
.PALP
*OUT-S:LPUT
*
*IN-S:CON0,S:LPUT
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /LPUT
                /X PUTL(B,W,N). STORES 24 BITS OF N IN B,W.
                /S D=FTAKL( ) RETRIEVES IT..2 DISK WORDS PER VARIABLE!!
                /
                *FNKB1+60
0724    2254    2254    /PUTL
0725    3544    3544    /TAKL
                *KB1+60
0220    6232    PUTL
0221    6245    TAKL
                *6232
6232    0000    PUTL,0
6233    1054      TAD ARG5
6234    3256      DCA TEMP
6235    1012      TAD ARG5H
6236    3051      DCA ARG2
6237    4520      JMS I PUTWRX
6240    1256      TAD TEMP
6241    2053      ISZ ARG4
6242    3051      DCA ARG2
6243    4520      JMS I PUTWRX
6244    5632      JMP I PUTL
                /
6245    0000    TAKL,0
6246    4541      JMS I GETWRX
6247    1051      TAD ARG2
6250    3256      DCA TEMP
6251    2053      ISZ ARG4
6252    4541      JMS I GETWRX
6253    1256      TAD TEMP
6254    3050      DCA ARG1
6255    5645      JMP I TAKL
                /
6256    0000    TEMP,0
```

(51)

Dec 20/73

```
.PALP
*OUT-S:MICR
*
*IN-S:CON0,S:GCON,S:MICR
*
*
*
*OPT-T

ALOCK  0107

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /MICR
                /S  D=FMICR(N)--READ X(N=0),OR Y(N=1)--MICROMETER
                /X  GMIC(N,C)-START MICR. N-DISABLE NULL.C-FULL COUNT CHECK.
                /S  D=FMICS(M)--MICROMETER STATUS-MASKED BY M.
                /S  D=FLOC(N)-READ STAGE POSITION.
                /
                *READAX
0106  5400    READIT  /GEN PURPOSE I. O. ROUTINE
                *LOCX
0105  5454    LOCATE
                /
                *FNKB1+15
0661  0113    113     /GMIC
0662  1452    1452    /MICR
0663  1453    1453    /MICS
0664  1073    1073    /LOC
                *KB1+15
0155  6605    MICGO
0156  6623    MICRED
0157  6627    MCSTAT
0160  6644    LOCER
                /
                *6600
6600  0002    P2,2
6601  0200    P200,200
6602  4044    P4044,4044
6603  0400    P400,400
6604  0201    P201,201
                /
6605  0000    MICGO,0
6606  1052      TAD ARG3
6607  7650      SNA CLA
6610  5217      JMP FTEST
6611  1201      TAD P200        /DISABLE NULL
6612  1202    GOMIC,TAD P4044
6613  7140      CMA CLL
6614  4510      JMS I COMNDX
6615  6724      AMEG01
6616  5605      JMP I MICGO
                /
6617  1053    FTEST,TAD ARG4
6620  7640      SZA CLA
6621  1203      TAD P400        /FULL COUNT CHECK
```

```
6622  5212      JMP GOMIC
                /
6623  0000    MICRED,0
6624  1200      TAD P2
6625  4506      JMS I READAX
6626  5623      JMP I MICRED
                /
6627  0000    MCSTAT,0
6630  1204      TAD P201
6631  7040      CMA
6632  6723      SETAME
6633  6727      READAM
6634  7040      CMA
6635  3051      DCA ARG2
6636  1052      TAD ARG3
6637  7450      SNA
6640  5627      JMP I MCSTAT
6641  0051      AND ARG2
6642  3051      DCA ARG2        /MASKED
6643  5627      JMP I MCSTAT
                /
6644  0000    LOCER,0
6645  4505      JMS I LOCK
6646  5644      JMP I LOCER     /AME LOC. IN ARG1,ARG2
                /
                *5400    /CORE RESIDENT CODE
5400  0000    READIT,0          /ARG3=0 FOR X, =1 FOR Y
5401  3317      DCA CODE
5402  1052    RETRY,TAD ARG3
5403  7650      SNA CLA
5404  5241      JMP XREAD
5405  1316    YREAD,TAD PP400
5406  3320    COREAD,DCA OPCODE
5407  1320      TAD OPCODE
5410  1317      TAD CODE
5411  7040      CMA
5412  6723      SETAME
5413  6727      READAM
5414  7040      CMA             /HARDWARE IS REVERSED
5415  3050      DCA ARG1
5416  1320      TAD OPCODE
5417  7104      CLL RAL
5420  1317      TAD CODE
5421  7040      CMA
5422  6723      SETAME
5423  6727      READAM
5424  7040      CMA
5425  3051      DCA ARG2        /LOW ORDER PART
5426  1050      TAD ARG1
5427  7041      CIA
5430  1250      TAD HITEM       /THIS ALWAYS FORCES DOUBLE READ
5431  7640      SZA CLA
5432  5243      JMP BAD
5433  1051      TAD ARG2
5434  7041      CIA
5435  1251      TAD LOWTEM
5436  7640      SZA CLA
5437  5243      JMP BAD
5440  5600      JMP I READIT
5441  1315    XREAD,TAD PP2000
```

```
5442  5206    JMP GOREAD
              /
5443  1050  BAD,TAD ARG1
5444  3250    DCA HITEM
5445  1051    TAD ARG2
5446  3251    DCA LOWTEM      /BE SURE READING IS REPRODUCIBLE
5447  5202    JMP RETRY
              /
5450  0000  HITEM,0
5451  0000  LOWTEM,0
5452  0000  PARITY,0
5453  0000  TEMP,0
              /
              /
5454  0000  LOCATE,0
5455  7001  IAC             /READ CARRIAGE POSITION
5456  4200    JMS READIT
5457  3252  LOPART,DCA PARITY
5460  1051    TAD ARG2
5461  7421    MQL             /CONVERT LOW ENCODER
5462  4321    JMS CONVER
5463  7112    CLL RTR
5464  7012    RTR
5465  7010    RAR   /TOP DIGIT
5466  3051    DCA ARG2
5467  4321    JMS CONVER
5470  7106    CLL RTL         /MIDDLE DIGIT
5471  7006    RTL
5472  1051    TAD ARG2
5473  3051    DCA ARG2
5474  4321    JMS CONVER
5475  1051    TAD ARG2        /LOW DIGIT
5476  3051    DCA ARG2
5477  3252    DCA PARITY
5500  1050  HIPART,TAD ARG1 /NOW CONVERT HI ENCODER
5501  7106    CLL RTL
5502  7006    RTL
5503  7421    MQL             /TOP DIGIT
5504  4321    JMS CONVER
5505  7106    CLL RTL
5506  7006    RTL             /STORES AS MIDDLE DIGIT
5507  3050    DCA ARG1
5510  4321    JMS CONVER
5511  1050    TAD ARG1
5512  3050    DCA ARG1        /LOW DIGIT,HI PART
5513  4511    JMS I BCDSNX
5514  5654    JMP I LOCATE
              /
5515  2000  PP2000,2000
5516  0400  PP400,400
5517  0000  CODE,0
5520  0000  OPCODE,0
              /
5521  0000  CONVER,0        /CONVERT GREY CODE..-VE OUT IF ERROR
5522  7413    SRL
5523  0003    3
5524  3253    DCA TEMP
5525  1252    TAD PARITY    /TEST PARITY OF PRECEEDING DIGIT
5526  7700    SMA CLA
5527  5336    JMP EVEN
```

```
5530  1253     TAD TEMP
5531  7112     CLL RTR
5532  7012     RTR              /PUT BIT 'D' IN LINK
5533  7026     CML RTL          /COMPLEMENT DATEX BIT 'D'
5534  7006     RTL
5535  7410     SKP
5536  1253  EVEN,TAD TEMP
5537  1351     TAD LIST
5540  3253     DCA TEMP
5541  1653     TAD I TEMP       /CONVERTED DIGIT FROM TABLE
5542  7012     RTR
5543  3252     DCA PARITY       /PARITY FOR NEXT LOWER DIGIT
5544  1653     TAD I TEMP
5545  7500     SMA
5546  5721     JMP I CONVER
5547  ~~5753~~7300 ~~DCA ANC~~CLA CLL/-VE OUT FOR DATEX ERROR
5550  ~~5754~~5255 JMP ~~I LOOP~~ REPEAT   /repeat if impossible code
5551  5552  LIST,ONE-1
5552  7777  ZERO,-1
5553  0000  ONE,0
5554  0002  TWO,2
5555  0001  THREE,1
5556  0004  FOUR,4
5557  7777   FIVE,-1
5560  0003  SIX,3
5561  7777   SEVEN,-1
5562  7777   EIGHT,-1
5563  0011  NINE,9
5564  0007  TEN,7
5565  0010  ELEVEN,8
5566  0005  TWELVE,5
5567  7777   THRTEN,-1
5570  0006  FORTEN,6
5571  7777   FIFTEN,-1
```

/ could hang up

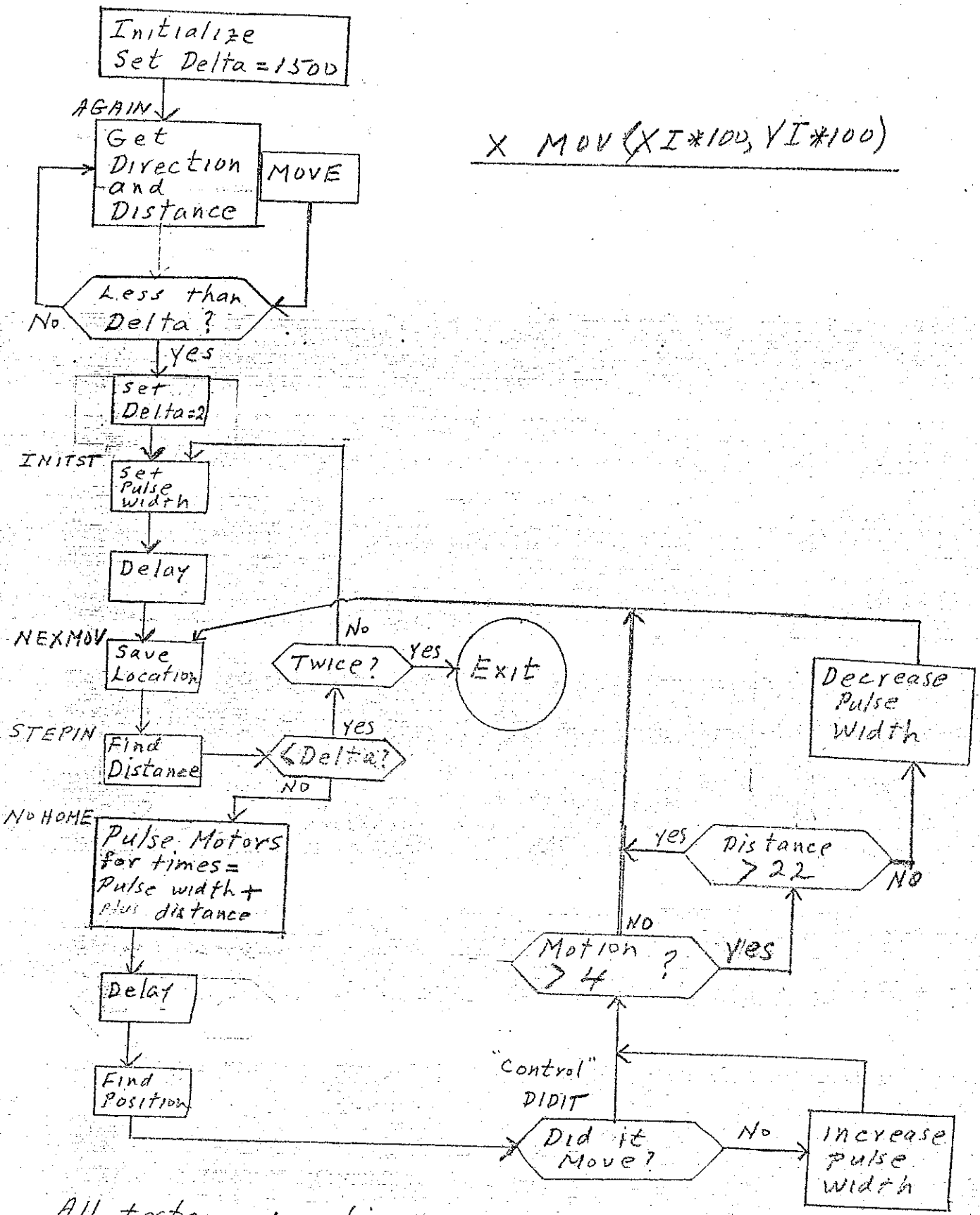
```
.PALP
*OUT-S:MISC
*
*IN-S:CON0,S:GCON,S:MISC
*
*
*
*OPT-T

ACLEAR 6500

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /MISC
                /S D=FOR(N,M) FOR INCLUSIVE 'OR' OF N,M
                /S D=FAND(M,N) FOR 'AND' PRODUCT OF M,N.
                /S D=FTEST(M) TESTS CONDITION..M=:1-PHOT;2-SCAN;4-MICR.
                /RETURNS 1,2 AND/OR 4 IF DONE.
                /X CLER(N):RESETS SELECTED DEVICE TO ZERO.
                /X AME(N):START AME FOR N>0.HALT FOR N=0.
                /
                *FNKB1+44
0710    3512    3492      /OR
0711    0254    254       /TEST
0712    3772    3772      /CLER
0713    3564    3564      /AND
0714    3555    3555      /AME
                *KB1+44
0204    6425    OR
0205    6447    TEST
0206    6475    CLER
0207    6415    ANDER
0210    6514    AMEGO
                /
                *6400
6400    0004    P4,4
6401    7670    P7670,7670
6402    0700    P700,700
6403    0000    CNTR,0
6404    7776    M2,-2
6405    0000    FUNC,0
                /
6406    6406    LIST,.
6407    1044    1044
6410    0004    4
6411    1024    1024
6412    0002    2
6413    1014    1014
6414    0001    1
                /
6415    0000    ANDER,0
6416    1052      TAD ARG3
6417    0053      AND ARG4
6420    3051      DCA ARG2
6421    1010      TAD ARG3H
6422    0011      AND ARG4H
```

```
6423  3050     DCA ARG1
6424  5615     JMP I ANDER
               /
6425  0000   OR,0
6426  1052     TAD ARG3
6427  7040     CMA
6430  3052     DCA ARG3
6431  1053     TAD ARG4
6432  7040     CMA
6433  0052     AND ARG3
6434  7040     CMA
6435  3051     DCA ARG2
               /
6436  1010     TAD ARG3H
6437  7040     CMA
6440  3010     DCA ARG3H
6441  1011     TAD ARG4H
6442  7040     CMA
6443  0010     AND ARG3H
6444  7040     CMA
6445  3050     DCA ARG1
6446  5625    JMP I OR
               /
6447  0000   TEST,0
6450  1052     TAD ARG3
6451  7104     CLL RAL
6452  7006      RTL
6453  3205     DCA FUNC        /SETTING UP THE ACCESS CODE
               /
6454  3051     DCA ARG2        /CLEAR IT
6455  1206     TAD LIST
6456  3010     DCA 10
6457  1204     TAD M2
6460  3203     DCA CNTR
6461  1205   NEXT,TAD FUNC
6462  0410     AND I 10
6463  7160     CMA STL         /USE PREVIOUS NULL,FCC BITS BY STL
6464  4510     JMS I COMNDX    /LOAD CONTROL BUFFER
6465  1410     TAD I 10
6466  6722     SKIPAM
6467  7200     CLA             /NOT DONE
6470  1051     TAD ARG2
6471  3051     DCA ARG2        /ADD RESULT TO ANSWER
6472  2203     ISZ CNTR
6473  5261     JMP NEXT
6474  5647    JMP I TEST
               /
6475  0000   CLER,0
6476  1313     TAD M20
6477  3061     DCA ARG10       / NEEDS SEVERAL PULSES AFTER GEN. RESET
6500  1052   ACLEAR,TAD ARG3
6501  7112     CLL RTR
6502  7012     RTR
6503  7160     CMA STL         /USE OLD NULL,FCC
6504  4510     JMS I COMNDX    /LOAD CONTROL BUFFER
6505  6725     ARESET          /RESET SELECTED DEVICE(S)
6506  2060     ISZ ARG9
6507  5306     JMP .-1         /DELAY BETWEEN PULSES
6510  2061     ISZ ARG10       /COUNT PULSES
6511  5300     JMP ACLEAR
```

```
6512  5675    JMP I CLER
              /
6513  7760    M20,-20
              /
6514  0000    AMEGO,0
6515  1052      TAD ARG3
6516  7650      SNA CLA
6517  5330      JMP STOP
6520  1200      TAD P4
6521  3052      DCA ARG3
6522  4275      JMS CLER        /RESETS HARDWARE IN CASE GEN. RESET ON
6523  1202      TAD P700        /CLEAR FCC,NULL-OFF,OR GEN. RESET
6524  7100      CLL
6525  4510      JMS I COMNDX
6526  6721      6721            /START AME
6527  5714      JMP I AMEGO
6530  1201    STOP,TAD P7670    /100*CMA-SET GENERAL RESET LEVEL
6531  4510      JMS I COMNDX    /LINK DOESN'T MATTER HERE
6532  5714      JMP I AMEGO
```



All tests and motions are done for both x and y individually but simultaneously.

(59)

File 2 Tape 15B
JAN 31/74

```
.PALP
*OUT-S:MOVE
*
*IN-S:CON0,S:GCON,S:MOVE,S:MOV2
*
*
*
*
*OPT-T

AGAIN  6215

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /MOVE
                /X MOVE(X*100,Y*100) MOVES STAGE TO X,Y MM.
                /FINDIT IN 'STEP',AND LOCATE IN 'MICR' ARE USED VIA FINDEX
                /S D=FMOVE(X,Y) WILL GIVE -VE D IF NOT FOUND.
                /
                MOTOR=6733
                /
                XLOW=ARG5
                XHIGH=ARG5H
                YLOW=ARG6
                YHIGH=ARG6H
                DIREC=ARG7H
                FDIREC=ARG8H
                COUNT=ARG7
                DELTA=ARG8
                REVCNT=ARG9
                XWIDTH=ARG9H
                YWIDTH=ARG10H
                /
                *KB1+55
0215   6200     MOVE
                *FNKB1+55
0721   1216     1216    /MOV
                *6200
6200   0000     MOVE,0
6201   1052       TAD ARG3
6202   3054       DCA XLOW
6203   1053       TAD ARG4
6204   3055       DCA YLOW
6205   1010       TAD ARG3H
6206   3012       DCA XHIGH
6207   1011       TAD ARG4H
6210   3013       DCA YHIGH
6211   1325       TAD P1500
6212   3057       DCA DELTA
6213   1324       TAD M20
6214   3060       DCA REVCNT    /REVERSING COUNT
6215   4720     AGAIN,JMS I FINDRX
6216   1014       TAD DIREC
6217   7040       CMA
6220   6733       MOTOR
6221   1014       TAD DIREC
6222   7640       SZA CLA
```

```
6223  5215     JMP AGAIN
6224  7305     CLA IAC CLL RAL        /+2
6225  3057     DCA DELTA
6226  7344     CLL CLA CMA RAL        /-2
6227  3347     DCA TSEXIT
6230  1346  INITST, TAD M140
6231  3016     DCA XWIDTH
6232  1346     TAD M140
6233  3017     DCA YWIDTH
6234  1324     TAD M20
6235  3060     DCA REVCNT
6236  1324     TAD M20
6237  4716     JMS I DELAYX   /LET IT SLOW DOWN
6240  1334  NEXMOV, TAD XDIST0
6241  3335     DCA XDIST
6242  1341     TAD DISTLO
6243  3342     DCA YDIST      /SAVE CURRENT LOCATION
6244  4720  STEPIN, JMS I FINDRX
6245  1014     TAD DIREC
6246  7640     SZA CLA
6247  5255     JMP NOHOME
6250  2347  EXIT, ISZ TSEXIT
6251  5230     JMP INITST     /BE SURE IT IS STOPPED
6252  7240  EXIT2, CLA CMA
6253  6733     MOTOR          /STOP IT FOR SURE
6254  5600     JMP I MOVE     /EXIT
               /
6255  1335  NOHOME, TAD XDIST
6256  7041     CIA
6257  1016     TAD XWIDTH
6260  3321     DCA XTIME
6261  1341     TAD DISTLO     /Y DISTANCE
6262  7041     CIA
6263  1017     TAD YWIDTH
6264  3322     DCA YTIME
6265  1014     TAD DIREC
6266  7040     CMA
6267  6733     MOTOR
6270  2321  XWAIT, ISZ XTIME
6271  7410     SKP
6272  5306     JMP XDONE
6273  2322  YWAIT, ISZ YTIME
6274  7410     SKP
6275  5312     JMP YDONE
6276  1014  CONTROL, TAD DIREC
6277  7040     CMA
6300  6733     MOTOR
6301  1014     TAD DIREC
6302  7640     SZA CLA
6303  5270     JMP XWAIT
6304  4327  JMS DIDIT         /DID IT MOVE
6305  5240     JMP NEXMOV
               /
6306  1014  XDONE, TAD DIREC
6307  0323     AND P3         /REMOVE X
6310  3014     DCA DIREC
6311  5276     JMP CONTROL
               /
6312  1014  YDONE, TAD DIREC
6313  0326     AND P14        /REMOVE Y
```

```
6314  3014    DCA DIREC
6315  5276    JMP CONTROL
              /
6316  5000    DELAYX,DELAY
6317  5132    TRYITX,TRYIT
6320  5010    FINDRX,FINDER
6321  0000    XTIME,0
6322  0000    YTIME,0
              /
              /
              /
6323  0003    P3,3
6324  7760    M20,-20
6325  1500    P1500,1500
6326  0014    P14,14
              /
6327  0000    DIDIT,0
6330  7240      CLA CMA       /MOTOR OFF TIME
6331  4716      JMS I DELAYX
6332  4720      JMS I FINDRX
6333  4717    XTEST,JMS I TRYITX
6334  0000    XDIST0,0
6335  0000    XDIST,0
6336  1016      TAD XWIDTH
6337  3016      DCA XWIDTH
6340  4717    YTEST,JMS I TRYITX
6341  0000    DISTLO,0
6342  0000    YDIST,0
6343  1017      TAD YWIDTH
6344  3017      DCA YWIDTH
6345  5727      JMP I DIDIT
              /
6346  7640    M140,-140
6347  0000    TSEXIT,0
              /
              *5000   /CORE RESIDENT CODE
5000  0000    DELAY,0
5001  3364      DCA TEMP
5002  3056      DCA COUNT
5003  2056    DELAYR,ISZ COUNT
5004  5203      JMP .-1
5005  2364      ISZ TEMP
5006  5203      JMP DELAYR    /WAIT FOR MOTION TO CEASE
5007  5600      JMP I DELAY
              PAUSE/
              /
              /MOV2
5010  0000    FINDER,0        /READ AND FIND DISTANCE AND DIRECTION
5011  3014      DCA DIREC
5012  4504      JMS I FINDX   /READ AND DISPLAY POSITION(SEE PROG."STEP")
5013  1052      TAD ARG3
5014  7141      CLL CIA
5015  1054      TAD XLOW
5016  3762      DCA I DISLOY
5017  7430      SZL
5020  7240      CLA CMA       /ALLOW FOR CARRY
5021  1010      TAD ARG3H
5022  7040      CMA
5023  1012      TAD XHIGH
5024  3365      DCA DISTHI
```

```
5025  4300     JMS SIGNIT
5026  7774  XMINUS,4-10        /ARGUMENTS
5027  0010  XPLUS,10
5030  7430     SZL             /RETURNS HERE FROM SIGNIT
5031  3014     DCA DIREC       /X IS INSIDE DELTA
5032  1762     TAD I DISLOY
5033  7510     SPA
5034  7040     CMA             /RETURN +VE DISTANCE
5035  3763     DCA I DISLOX
5036  1053     TAD ARG4
5037  7141     CLL CIA
5040  1055     TAD YLOW
5041  3762     DCA I DISLOY    /Y DISTANCE LOW
5042  7430     SZL
5043  7240     CLA CMA         /CARRY
5044  1011     TAD ARG4H
5045  7040     CMA
5046  1013     TAD YHIGH
5047  3365     DCA DISTHI
5050  4300     JMS SIGNIT
5051  7777  YMINUS,1-2
5052  0002  YPLUS,2            /MOTOR DRIVE CODE
5053  1014     TAD DIREC       /RETURN FROM SIGNIT HERE
5054  7430     SZL
5055  0361     AND PP14        /Y IS CLOSE ENOUGH TO POINT
5056  3014     DCA DIREC
5057  1762     TAD I DISLOY
5060  7510     SPA
5061  7040     CMA
5062  3762     DCA I DISLOY    /MAKE +VE FOR SMALL DISTANCES
5063  1014     TAD DIREC
5064  7041     CIA
5065  1015     TAD FDIREC
5066  7650     SNA CLA
5067  5610     JMP I FINDER
5070  1014     TAD DIREC       /SAVE DIRECTION
5071  3015     DCA FDIREC
5072  2060     ISZ REVCNT      /COUNT DIRECTION REVERSALS
5073  5610     JMP I FINDER
5074  7240     CLA CMA
5075  3050     DCA ARG1        /RETURN -VE IF TOO MANY
5076  5677     JMP I EXITXX
5077  6252  EXITXX,EXIT2
            /
            /
5100  0000  SIGNIT,0           /SETS DIRECTION
5101  1365     TAD DISTHI
5102  7700     SMA CLA
5103  1700     TAD I SIGNIT    /-VE MOTION WANTED
5104  2300     ISZ SIGNIT
5105  1700     TAD I SIGNIT
5106  2300     ISZ SIGNIT
5107  1014     TAD DIREC       /ADD TO DIREC
5110  3014     DCA DIREC
5111  1365     TAD DISTHI
5112  7004     RAL             /SAVE SIGN
5113  7200     CLA
5114  1365     TAD DISTHI
5115  7510     SPA
5116  7040     CMA
```

```
5117  7640     SZA CLA
5120  5330     JMP BIG          /MOST SIGNIFICANT PART TOO BIG
5121  1762     TAD I DISLOY
5122  7430     SZL
5123  7041     CIA              /COMPLEMENT -VE NO.
5124  7141     CLL CIA
5125  1057     TAD DELTA        /DELTA-DISTLO
5126  7200     CLA              /L=1 IF DISTLO <DELTA
5127  5700     JMP I SIGNIT
               /
5130  7300   BIG,CLA CLL
5131  5700     JMP I SIGNIT
               /
               /
5132  0000   TRYIT,0 /COMPARE DISTANCES,GET A WIDTH CORRECTION
5133  3364     DCA TEMP
5134  1732     TAD I TRYIT
5135  2332     ISZ TRYIT
5136  7041     CIA
5137  1732     TAD I TRYIT      /NEW DISTANCE
5140  2332     ISZ TRYIT
5141  7421     MQL
5142  7501     MQA              /NEW DISTANCE SAVED
5143  7450     SNA
5144  2364     ISZ TEMP         /NO MOTION
5145  0357     AND P7774
5146  7650     SNA CLA
5147  5354     JMP TRYDON       /NOT TOO BIG A MOTION
5150  7501     MQA
5151  1360     TAD M22
5152  7700     SMA CLA
5153  7240     CLA CMA          /SMALL DISTANCE,LARGE MOTION,SLOWW DOWN
5154  1364   TRYDON,TAD TEMP
5155  7040     CMA
5156  5732     JMP I TRYIT
               /
5157  7774   P7774,7774
5160  7756   M22,-22
5161  0014   PP14,14
5162  6341   DISLOY,DISTLO    /Y DISTANCE SAVER
5163  6334   DISLOX,XDIST0
5164  0000   TEMP,0
5165  0000   DISTHI,0
```

File 4, Tape 12M
Jan. 15/73

(64)

```
.PALP
*OUT-S:NAME
*
*IN-S:CON0,S:NAME
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /NAME
                /X NAME(N) REPLACES DISC OVERLAY#6 FROM TAPE 8.
                /N=0 GIVES ORIGINAL SYSTEM OVERLAY.
                /X WHAT(G,N) TYPES I.D. FOR N OVERLAYS,STARTING AT G
                /USE NEGATIVE N TO DISABLE X NAME!
                /
                POUT=10
                PIN=11
                COUNT=ARG5
                /
                /
                *FNKB1+40
0704    1555    1555    /NAME
0705    3334    3334    /WHAT
                *KB1+40
0200    6230    NAME    /THIS LOC IS USED BY PCAL (CALCOMP LETTERS.)
0201    6340    WHAT
                /
                *6200
6200    0000    GTAPE,0 /READ FROM TAPE
6201    1325      TAD P710
6202    3026      DCA DSFELD
6203    3030      DCA DTUNIT
6204    1334      TAD M1065
6205    3024      DCA DDWCNT
6206    1052      TAD ARG3
6207    7450      SNA
6210    5221      JMP RESTOR    /GET ORIGINAL
6211    7106      CLL RTL       /X 4 BLOCKS
6212    1337      TAD OVBLOK
6213    3027      DCA DTBLOK
6214    1336      TAD P4066
6215    3023      DCA DDCORE
6216    4421      JMS I DTAPX   /GET NEW OVERLAY
6217    5216      JMP .-1
6220    5600      JMP I GTAPE
6221    1324    RESTOR,TAD P4000
6222    3023      DCA DDCORE    /PART OF THIS BLOCK IS UNNEEDED.
6223    1335      TAD P65
6224    3027      DCA DTBLOK    /PART OF INITIAL OVERLAY.
6225    4421      JMS I DTAPX
6226    5225      JMP .-1       /ERROR
6227    5600      JMP I GTAPE
                /
6230    0000    NAME,0
6231    1052      TAD ARG3
```

```
6232  7041     CIA
6233  1134     TAD NOWNAM
6234  7650     SNA CLA          /IS IT ALREADY ON DISK?
6235  5630     JMP I NAME       /YES
6236  4200     JMS GTAPE
6237  1052     TAD ARG3
6240  7650     SNA CLA
6241  5250     JMP OK           /DON'T TEST ORIGINAL.
6242  1736     TAD I P4066
6243  1323     TAD M1234
6244  7650     SNA CLA
6245  5250     JMP OK
6246  4530     JMS I CRLFX      /SO ERROR PRINT IS SEEN
6247  5532     JMP I KILALL     /MAGIC WORD WRONG
6250  1321  OK, TAD KB65
6251  3010     DCA POUT
6252  1330     TAD M12
6253  3054     DCA COUNT
6254  1326     TAD P60
6255  3410     DCA I POUT       /RESETTING DISPATCH TABLE.
6256  2054     ISZ COUNT
6257  5254     JMP .-3
6260  1322    TAD P4101         /KB1+66
6261  3023     DCA DDCORE
6262  1327     TAD M752
6263  3024     DCA DDWCNT
6264  1331     TAD P7026        /OVERLAY 6 ADDRESS ON DISC
6265  3025     DCA DISADD
6266  6002     IOF
6267  3126     DCA INTRUP       /MUST GO TO COMPLETION
6270  3041     DCA DTEST        /ALLOW SYSTEM REWRITE
6271  1332     TAD P2
6272  4420     JMS I DISCX      /REWRITE DISC
6273  7000     OPR              /DISC ERROR-NEVER GETS HERE!
6274  2041     ISZ DTEST        /RESTORE PROTECTION.
6275  1052     SETNAM, TAD ARG3
6276  7650     SNA CLA
6277  1317     TAD DIFREN       /NAMES #0 AT END OF OVERLAY
6300  1336     TAD P4066
6301  3011     DCA PIN
6302  1320     TAD FTAB65
6303  3010     DCA POUT
6304  1330     TAD M12
6305  3054     DCA COUNT
6306  1411  NEXNAM, TAD I PIN
6307  6201     CDF
6310  3410     DCA I POUT       /CHANGING NAME TABLE
6311  6211     CDF 10
6312  2054     ISZ COUNT
6313  5306     JMP NEXNAM
6314  1052     TAD ARG3
6315  3134     DCA NOWNAM       /RECORD CURRENT OVERLAY.
6316  5630     JMP I NAME
               /
6317  0764  DIFREN, 5052-4066
6320  6331  FTAB65, FLETER+65
6321  0225  KB65, KB1+65
6322  4101  P4101, 4101
6323  6544  M1234, -1234
6324  4000  P4000, 4000
```

```
6325  0710  P710,710
6326  0060  P60,60
6327  7026  M752,-752
6330  7766  M12,-12
6331  7026  P7026,7026
6332  0002  P2,2
6333  7772  M6,-6
6334  6713  M1065,-1065
6335  0065  P65,65
6336  4066  P4066,4066
6337  0130  OVBLOK,134-4
            /
6340  0000  WHAT,0
6341  1053    TAD ARG4
6342  7040    CMA
6343  3054    DCA COUNT       /NAME COUNT
6344  4200  LOADIT,JMS GTAPE
6345  4530    JMS I CRLFX
6346  1052    TAD ARG3
6347  1375    TAD P260
6350  4527    JMS I TYPEX
6351  1376    TAD P272
6352  4527    JMS I TYPEX     /PRINT N:
6353  1736    TAD I P4066
6354  1323    TAD M1234
6355  7640    SZA CLA
6356  5364    JMP NEXT        /NOT AN OVERLAY
6357  1370    TAD MESDO
6360  3773    DCA I P5050
6361  1371    TAD RETRN1
6362  3774    DCA I P5071
6363  4772    JMS I P5047
6364  2052  NEXT,ISZ ARG3
6365  2054    ISZ COUNT
6366  5344    JMP LOADIT
6367  5740    JMP I WHAT
            /
6370  4422  MESDO,JMS I MESAGX
6371  5647  RETRN1,5647       /JMP I 5047(SUBROUTINE EXIT)
6372  5047  P5047,5047
6373  5050  P5050,5050
6374  5071  P5071,5071
6375  0260  P260,260
6376  0272  P272,272
```

Tape 15B (Files)
Feb 25/74.

(67)

```
.PALP
*OUT-S:PHOT
*
*IN-S:CON0,S:GCON,S:PHOT
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /PHOT
                /S D=FPHOR(0);READ PHOTOMETER
                /X GPHO(N,C)-START ".N--NULL OFF;C--FULL COUNT CHECK.
                /S D=FPHOS(M) READ PHOT STATUS--MASK M
                /
                *FNKB1+26
0672    0512    512     /PHOR
0673    0417    417     /GPHO
0674    0513    513     /PHOS
                *KB1+26
0166    6207    RPHOT
0167    6254    GOPHOT
0170    6237    PSTAT
                /
                *6200
6200    1014    P1014,1014
6201    0200    P200,200
6202    0400    P400,400
6203    0022    P22,22
6204    0042    P42,42
6205    0021    P21,21
6206    0041    P41,41
                /
6207    0000    RPHOT,0
6210    1204    PTRY,TAD P42
6211    7040      CMA
6212    6723      SETAME
6213    6727      READAM
6214    7040      CMA
6215    3051      DCA ARG2
6216    1203      TAD P22
6217    7040      CMA   /HARDWARE IS INVERTED
6220    6723      SETAME
6221    6727      READAM
6222    7040      CMA
6223    3050      DCA ARG1
6224    1050      TAD ARG1
6225    1051      TAD ARG2
6226    7041      CIA
6227    1236      TAD PHOTEM
6230    7650      SNA CLA
6231    5607      JMP I RPHOT
6232    1050      TAD ARG1
```

```
6233  1051     TAD ARG2
6234  3236     DCA PHOTEM     /THIS FORCES A REREAD
6235  5210     JMP PTRY       /REPEAT READ
               /
6236  0000   PHOTEM,0
               /
6237  0000   PSTAT,0
6240  1206     TAD P41
6241  7040     CMA
6242  6723     SETAME
6243  6727     READAM
6244  7040     CMA
6245  3051     DCA ARG2
6246  1052     TAD ARG3
6247  7450     SNA
6250  5637     JMP I PSTAT
6251  0051     AND ARG2
6252  3051     DCA ARG2       /MASK
6253  5637     JMP I PSTAT
               /
6254  0000   GOPHOT,0
6255  1052     TAD ARG3
6256  7650     SNA CLA
6257  5266     JMP FTEST
6260  1201     TAD P200
6261  1200   PHOTGO,TAD P1014
6262  7140     CMA CLL
6263  4510     JMS I COMNDX   /LOAD CONTROL BUFFER
6264  6724     AMEGO1
6265  5654     JMP I GOPHOT
6266  1053   FTEST,TAD ARG4
6267  7650     SNA CLA
6270  5261     JMP PHOTGO
6271  1202     TAD P400
6272  5261     JMP PHOTGO
               /
```

(69)

Tape 125
Aug 28/72

```
.PALP
*OUT-S:PUTN
*
*IN-S:CON0,S:PUTN
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /PUTN
                /X PUTN(B,W,X0,N,I)
                /LOADS N SUCCESSIVE DISC WORDS,STARTING AT BLOCK B,
                /WORD W,WITH NUMBERS: X0,X0+I,X0+2*I  ETC
                /
                *KB1+33
0173    6304    PUTTER
                *FNKB1+33
0677    2256    2256    /PUTN
                /
                *6304
6304    0000    PUTTER,0
6305    4540        JMS I KB1       /"PUT" IN GWRD
6306    3052        DCA ARG3
6307    3053        DCA ARG4
6310    1055        TAD ARG6
6311    7450      SNA
6312    5704      JMP I PUTTER
6313    7041       CIA
6314    3055       DCA ARG6
6315    5322      JMP TEST
6316    1054    NEXT,TAD ARG5
6317    1056        TAD ARG7
6320    3054        DCA ARG5
6321    4540        JMS I KB1
6322    2055    TEST,ISZ ARG6
6323    5316        JMP NEXT
6324    4537      JMS I BWRITX  /PUT LAST BLOCK ON DISK
6325    5704       JMP I PUTTER

.
```

File 4 Tape 12C
Aug 23/71

(70)

```
.PALP
*OUT-S:SAV4
*
*IN-S:CON0,S:SAV4
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /SAV4
                /STORE AND RETRIEVE FLOATING VARIABLES FROM DISC-3 OR 4 WOS
                /X STOR(B,W;V) STORES VARIABLE V STARTING
                /AT WORD W OF BLOCK B.  S D=FASK(B,W) PUTS IT IN D
                /
                *KB1+6
0146    6546    FSTORE
0147    6562    FDISC
                /
                *FNKB1+6
0652    1112    1112    /STOR
0653    3643    3643    /ASK
                /
                *6770
6770    0000    FLSET,0
6771    7240        CLA CMA
6772    1035        TAD FLACR
6773    3016        DCA 16
6774    1377        TAD M4
6775    3017        DCA 17
6776    5770        JMP I FLSET
6777    7774    M4,-4
                /
                *6545
6545    6770    FLSETG,FLSET
6546    0000    FSTORE,0
6547    4745        JMS I FLSETG
6550    6201    FONEXT,CDF
6551    1416        TAD I 16
6552    6211        CDF 10
6553    3051        DCA ARG2
6554    4520        JMS I PUTWRX
6555    3052        DCA ARG3
6556    3053        DCA ARG4        /0 IS USED TO SELECT NEXT ADDRESS
6557    2017        ISZ 17
6560    5350        JMP FONEXT
6561    5746        JMP I FSTORE
                /
6562    0000    FDISC,0             /VARIABLE FROM DISC
6563    4745        JMS I FLSETG
6564    4541    FINEXT,JMS I GETWRX
6565    1051        TAD ARG2
6566    6201        CDF
6567    3416        DCA I 16
6570    6211        CDF 10
6571    3052        DCA ARG3
```

```
6572  3053      DCA ARG4      /GET SEQUENTIAL ADDRESSES
6573  2017      ISZ 17
6574  5364      JMP FINEXT
6575  2362      ISZ FDISC     /SO LFOC DOESN'T CHANGE FLAC
6576  5762      JMP I FDISC
                /
```

File 3 Tape 15B
Dec. 6/73

(22)

```
.PALP
*OUT-S:SAVX
*
*IN-S:CON0,S:CCON,S:SAVX
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /CCON
                XLIST
                PAUSE/
                /
                /SAVX
                /X SAVX(FIRST BLOCK,INDEX NO,X,XM,XS,STAR NO.)
                /X SAVY(0,N,Y,YM,YS,PHOTOMETER)
                /16 WORDS PER STAR ONOUTPUT.
                /
                *FIXBI+10
0654    2710    2710    /SAVX
0655    2711    2711    /SAVY
                *KBI+10
0150    6044    SAVEX
0151    6073    SAVEY
                /
                *6042
6042    0002    P2,2
6043    0030    P30,30
                /
6044    0000    SAVEX,0
6045    1253      TAD ARG4
6046    7106      CLL RTL
6047    7006    SAVIT,RTL       /X 16
6050    1243      TAD P30       /FIRST 40 WORDS FOR I.D.
6051    3053      DCA ARG4
6052    1012      TAD ARG5H
6053    4302      JMS PUTIT
6054    1054      TAD ARG5
6055    4302      JMS PUTIT
6056    1013      TAD ARG6H
6057    4302      JMS PUTIT
6060    1055      TAD ARG6
6061    4302      JMS PUTIT
6062    1014      TAD ARG7H
6063    4302      JMS PUTIT
6064    1056      TAD ARG7
6065    4302      JMS PUTIT
6066    1015      TAD ARG8H
6067    4302      JMS PUTIT
6070    1057      TAD ARG8
6071    4302      JMS PUTIT
6072    5644      JMP I SAVEX
                /
6073    0000    SAVEY,0
6074    1273      TAD SAVEY
6075    3244      DCA SAVEX
```

```
6076  1053    TAD ARG4
6077  7136    CLL RTL
6100  1242    TAD P2          /OFFSET 8 WORDS
6101  5247    JMP SAVIT
              /
6102  0000  PUTIT,0
6103  3051    DCA ARG2
6104  4523    JMS I PUTWRX
6105  3052    DCA ARG3
6106  3053    DCA ARG4        /FOR SEQUENTIAL DISK ACCESS
6107  5702    JMP I PUTIT
```

(74)

File 3 Tape 15B
Feb. 25/64

```
.PALP
*OUT-S:SCAN
*
*IN-S:CON0,S:GCON,S:SCAN
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /SCAN
                /S  D=FSCNR(N)--READ X(N=0),OR Y(N=1) SCANNER.
                /X  GSCN(N,C) START SCANNER.N-DISABLE NULL,C-FULL COUNT CHECK
                /S  D=FSCNS(M)--SCANNER STATUS MASK M
                /
                *FNKB1+21
0665   3002     3002      /SCNR
0666   0646     646       /GSCN
0667   3003     3003      /SCNS
                *KB1+21
0161   6322     SCNRED
0162   6304     GOSCAN
0163   6346     SCSTAT
                /
                *6300
6300   0200     P200,200
6301   2024     P2024,2024
6302   0400     P400,400
6303   0002     P2,2
                /
6304   0000     GOSCAN,0
6305   1052       TAD ARG3
6306   7650       SNA CLA
6307   5316       JMP FTEST
6310   1300       TAD P200                    (for F.C.C.)
6311   1301     SCNGO,TAD P2024 /3024 TRIED,BUT SENDS PHOT TO LIMIT.
6312   7140       CMA CLL
6313   4510       JMS I COMNDX  /USE 'COMD' TO LOAD CONTROL BUFFER
6314   6724       AMEGO1        /START SELECTED FUNCTION
6315   5704       JMP I GOSCAN
6316   1053     FTEST,TAD ARG4
6317   7640       SZA CLA
6320   1302       TAD P400
6321   5311       JMP SCNGO
                /
6322   0000     SCNRED,0
6323   1052     STRY,TAD ARG3
6324   7650       SNA CLA
6325   1076       TAD P100      /READ X
6326   1076       TAD P100
6327   1303       TAD P2
6330   7040       CMA
6331   6723       SETAME
```

```
6332  6727    READAM
6333  7040    CMA
6334  3051    DCA ARG2
6335  1051    TAD ARG2
6336  7041    CIA
6337  1345    TAD SCNTEM      /FORCING A REREAD
6340  7650    SNA CLA
6341  5722    JMP I SCNRED
6342  1051    TAD ARG2
6343  3345    DCA SCNTEM
6344  5323    JMP STRY
              /
6345  0000  SCNTEM,0
              /
6346  0000  SCSTAT,0
6347  1076    TAD P100
6350  7001    IAC
6351  7040    CMA
6352  6723    SETAME
6353  6727    READAM
6354  7040    CMA             /HARDWARE IS REVERSED
6355  3051    DCA ARG2
6356  1052    TAD ARG3
6357  7450    SNA
6360  5746    JMP I SCSTAT
6361  0051    AND ARG2
6362  3051    DCA ARG2        /MASKED
6363  5746    JMP I SCSTAT
              /
```

Oct 26/71

(76)

```
.PALP
*OUT-S:SHIF
*
*IN-S:CON0,S:XCON,S:SHIF
*
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /XCON
                FIELD 1
                XLIST
                PAUSE/
                /
                /SHIF
                / X SHFT(NB,NS) SHIFTS BLOCK NB BY NS WORDS
                /USE: E.G.  FOR J=1,20;X SHFT(NB-J*20,NS) WILL
                /SHIFT 20 BLOCKS STARTING AT BLOCK NB BY NS WORDS.
                /IF NS IS  -VE,START AT LOWEST BLOCK
                /
                *KB1+25
0165    6043    SHIFTR
                *FNKB1+25
0671    3404    3404    /SHFT
                /
                *6043
6043    0000    SHIFTR,0
6044    4537        JMS I BWRITX /PROTECT CORE BUFFER
6045    1052        TAD ARG3
6046    3116        DCA BLOKIN
6047    7100        CLL
6050    4524        JMS I MVBUFX
6051    7577        BUFERB
6052    1053        TAD ARG4
6053    7100        CLL
6054    1025        TAD DISADD
6055    3025        DCA DISADD
6056    7420        SNL
6057    5263        JMP DWRITE
6060    1076        TAD P100
6061    1026        TAD DSFELD
6062    3026        DCA DSFELD    /HIGH PART OF DISC ADDRESS
6063    1053    DWRITE,TAD ARG4
6064    7710        SPA CLA
6065    1077        TAD M100
6066    1026        TAD DSFELD
6067    3026        DCA DSFELD
6070    7326        CLL CML CLA RTL
6071    4420        JMS I DISCX  /REWRITE BUFFER IN NEW SPOT
6072    7000        OPR          /IGNORE DISC ERRORS
6073    7330        CLL CML CLA RAR
6074    3116        DCA BLOKIN           /FORCE DISC BUFFER INITIALIZE
6075    5643        JMP I SHIFTR
                /
```

```
*PALP
*OUT-S:SORT2
*
*IN-S:CON0,S:SORT2,S:SRT1,S:SWAP
*
*
*
*
*OPT-T

AD      6135

                /CON0
                XLIST
                PAUSE/
                /
                /SORT
                /X SORT(BLK NO.,  WORD NO.,WORD COUNT,OUTPUT BLK)
                /MAXIMUM WORD COUNT (NUMBER OF STAR DESCRIPTORS) IS 512
                /CON0
                OBUF=ARG10
                IBUF=ARG9
                COUNT=ARG8
                ITOP=ARG7
                FIELD 1
                *KB1+66
0226    6200    SORT
                *FNKB1+66
0732    0444    444   /SORT
                *6200
6200    0000    SORT,   0
6201    4746      JMS I PSETUP
6202    2060    GO,   ISZ IBUF
6203    1060      TAD IBUF  /CHECK POINTER, AT TOP YET?
6204    7041      CIA  /SETUP FOR SUBTRACTION
6205    1056      TAD ITOP
6206    7750      SPA!SNA!CLA
6207    5306      JMP FOUND  /NEXT STAR HAS BEEN FOUND
6210    6201      CDF 0
6211    1460      TAD I IBUF  /NO SO CONT
6212    7710      SPA!CLA  /CHECK IST FLAG WORD
6213    5373      JMP ADD4  /YES SO LOOK AT NEXT FILE
6214    2060      ISZ IBUF  /NO SO GET X Y
6215    1460      TAD I IBUF
6216    7421      MQL
6217    2060      ISZ IBUF
6220    1460      TAD I IBUF
6221    4750      DAD  /SUBTRACT PRESENT POSITION TO GET INCREMENTAL DIST
6222    6355      XLP
6223    7510      SPA  /POSITIVE? IF NOT TAKE ABSF
6224    4751      DPCM
6225    3362      DCA DX+1
6226    7501      MQA  /STORE FOR LATE COMPARE
6227    3361      DCA DX
6230    2060      ISZ IBUF  /GET Y
6231    1460      TAD I IBUF
6232    7421      MQL
6233    2060      ISZ IBUF
6234    1460      TAD I IBUF
6235    4750      DAD
6236    6357      YLP  /INCREMENTAL DIST
6237    7510      SPA  /ABSF AGAIN
```

```
6240  4751     DPCM
6241  3364     DCA DY+1
6242  7501     MQA  /STORE FOR LATE COMPARE
6243  3363     DCA DY
6244  1361     TAD DX  /NOW COMPARE DX DY
6245  7421     MQL
6246  1362     TAD DX+1
6247  4751     DPCM
6250  4750     DAD
6251  6363     DY  /DY-DX
6252  7700     SMA!CLA  /DX GT. DY?
6253  5260     JMP YGTX
6254  1361     TAD DX
6255  7421     MQL
6256  1362     TAD DX+1  /DX GT. DY SO LOAD IT
6257  5263     JMP COMP
6260  1363  YGTX,  TAD DY
6261  7421     MQL
6262  1364     TAD DY+1  /DY GT. DX SO LOAD IT
6263  3366  COMP,  DCA DH  /STORE THE LARGER INCREMENT
6264  7501     MQA
6265  3365     DCA DL
6266  1366     TAD DH  /DL IS STILL IN MQ
6267  4750     DAD  /CHECK THIS INCREMENT BY
6270  6367     DS  /SUBTRACTING THE SHORTEST INCREMENT SO FAR
6271  7700     SMA!CLA
6272  5202     JMP GO  /DS STILL THE SHORTEST
6273  1365     TAD DL  /HAVE FOUND A CLOSER CANDIDATE
6274  7421     MQL
6275  1366     TAD DH
6276  4751     DPCM  /SETUP FOR LATER SUBTRACTION
6277  3370     DCA DS+1
6300  7501     MQA
6301  3367     DCA DS
6302  1060     TAD IBUF  /GET ADD OF THIS FILE
6303  1371     TAD M4  /GET ADD OF FLAG WORD
6304  3372     DCA WHERE  /SAVE IT
6305  5202     JMP GO  /CONT THE SEARCH
6306  1772  FOUND,  TAD I WHERE  /GET FLAG WORD OF SORTED STAR
6307  6211     CDF 10
6310  3461     DCA I OBUF  /STORE FILE NUMBER IN OUTPUT BUFFER
6311  2061     ISZ OBUF  /SET FOR NEXT TIME THRU
6312  1354     TAD FLAG
6313  6201     CDF 0
6314  3772     DCA I WHERE  /SET FLAG BIT
6315  2372     ISZ WHERE
6316  1772     TAD I WHERE  /GET X COORDINATE
6317  7421     MQL
6320  2372     ISZ WHERE
6321  1772     TAD I WHERE
6322  4751     DPCM  /SETUP FOR SUBTRACTION
6323  3356     DCA XHP  /COMPLEMENT OF THE PRESENT POSITION OF THE STAR
6324  7501     MQA
6325  3355     DCA XLP
6326  2372     ISZ WHERE
6327  1772     TAD I WHERE  /SAME FOR Y
6330  7421     MQL
6331  2372     ISZ WHERE
6332  1772     TAD I WHERE
6333  4751     DPCM
```

```
6334  3360     DCA YHP
6335  7501     MQA
6336  3357     DCA YLP
6337  6211     CDF 10
6340  1747     TAD I PBEGIN
6341  3060     DCA IBUF  /RESET INPUT BUFF POINTER
6342  2057     ISZ COUNT  /SORT COMPLETE?
6343  5752     JMP I PSET  /RESET DIST TO FULL SCALE
6344  4753     JMS I POUT  /YES SO OUTPUT DATA
6345  5600     JMP I SORT  /RETURN TO FOCAL
6346  6400  PSETUP,  SETUP
6347  6473  PBEGIN,  BEGIN
6350  6113  PDADD,  DADD
6351  6100  PDCM,  DCM
6352  6560  PSET,  RESET  /USED TO RESET DIST TO FULL SCALE
                        /EACH TIME THRU

            DPCM=JMS I PDCM
            DAD=JMS I PDADD

6353  6536  POUT,  OUTPUT
6354  7770  FLAG,  7770
6355  0000  XLP,  0
6356  0000  XHP,  0
6357  0000  YLP,  0
6360  0000  YHP,  0
6361  0000  DX,  0
6362  0000       0
6363  0000  DY,  0
6364  0000       0
6365  0000  DL,  0
6366  0000  DH,  0
6367  0000  DS,  0  /LOADED BY SETUP
6370  0000    0
6371  7774  M4,  -4
6372  0000  WHERE,  0  /INPUT BUFFER POINTER
              /
6373  1060  ADD4,  TAD IBUF
6374  1377    TAD P4
6375  3060    DCA IBUF
6376  5202    JMP GO
6377  0004  P4,  4
            PAUSE/
            /
            /SRT1   ADDITIONAL PART OF SORT ROUTINE
            FIELD 1
            *6400
6400  0000  SETUP,  0        /SETS REGISTERS
6401  6002          IOF
6402  4712          JMS I PSWAP      /SWAP OUT FIELD 0
6403  1273          TAD BEGIN        /BEGINNING ADDRESS OF INPUT BUFFER
6404  3060          DCA IBUF
6405  1314          TAD MAX
6406  3704          DCA I PDSL
6407  1314          TAD MAX
6410  3705          DCA I PDSH       /RESET FULL SCALE INTO MIN DIST REG$
6411  1054          TAD ARG5
6412  7450          SNA      /CHECK FOR ZERO WORD COUNT
6413  5316          JMP ERR
6414  1315          TAD M1000        /CHECK FOR MORE THAN 1000 STARS
```

```
6415  7700          SMA!CLA /OCTAL OR 512 DECIMAL
6416  5316          JMP ERR
6417  1054          TAD ARG5
6420  3275          DCA NUM /SET UP NUMBER OF STARS TO SORT
6421  1275          TAD NUM
6422  7041          CIA
6423  3057          DCA COUNT       /ON TWO PAGES
6424  1275          TAD NUM
6425  7106          CLL!RTL /MULTIPLY BY 4
6426  1275          TAD NUM /+1 MORE IS 5X FOR 5 WORDS PER FILE
6427  1273          TAD BEGIN       /SET UP TOP OF INBUFF ADDRESS
6430  3056          DCA ITOP
6431  1274          TAD OBEGIN      /SETUP OUT BUFF
6432  3061          DCA OBUF
6433  1273          TAD BEGIN       /ON TWO PAGES
6434  3276          DCA BUFF
6435  2276          ISZ BUFF        /GET RIGHT START FOR INPUT
6436  1273          TAD BEGIN       /RESET WHERE POINTER
6437  7001          IAC
6440  3713          DCA I PWHERE    /TO FIRST WORD IN INPUT BUFF
6441  1275          TAD NUM
6442  7041          CIA
6443  3300          DCA CNTR        /WORD COUNTER FOR TRANSFER
6444  3277          DCA FILE        /RESET FILE NUMBERING REGIST
6445  3706          DCA I PXL       /RESET PRESENT POSITION TO ORIGIN
6446  3707          DCA I PXH
6447  3710          DCA I PYL
6450  3711          DCA I PYH
6451  1053          TAD ARG4
6452  1302          TAD P35
6453  3053          DCA ARG4        /LEAVE SPACE FOR LABELS
6454  2277  TRANS,  ISZ FILE
6455  1277          TAD FILE
6456  6201          CDF 0
6457  3676          DCA I BUFF
6460  6211          CDF 10
6461  1053          TAD ARG4        /MOVE UP TO GET X DATA
6462  1301          TAD P15
6463  3053          DCA ARG4
6464  4317          JMS GET
6465  2053          ISZ ARG4        /MOVE UP TO GET Y DATA
6466  4317          JMS GET
6467  2276          ISZ BUFF
6470  2300          ISZ CNTR
6471  5254          JMP TRANS
6472  5600          JMP I SETUP
6473  0177  BEGIN,  177       /INPUT BUFFER STARTING ADDRESS -1
6474  3000  OBEGIN, 3000      /OUTPUT BUFFER STARTING ADD
6475  0000  NUM,    0
6476  0000  BUFF,   0
6477  0000  FILE,   0         /USED TO PUT SUCESSIVE NUMBERS INTO FLAG WOD
6500  0000  CNTR,   0
6501  0015  P15,    15
6502  0035  P35,    35
6503  0000  TEMP,   0
6504  6367  PDSL,   DS        /POINTERS FOLLOW
6505  6370  PDSH,   DS+1
6506  6355  PXL,    XLP
6507  6356  PXH,    XHP
6510  6357  PYL,    YLP
```

```
6511  6360  PYH,     YHP
6512  6600  PSWAP,   SWAP
6513  6372  PWHERE,  WHERE
6514  5000  MAX,     -3000
6515  7000  M1000,   -1000    /512 MAX STARS
6516  7402  ERR,     HLT      /REPLACE WITH JMS I MESAGX
      /MORE SUBROUTINES
6517  0000  GET,     0        /GETS DATA FROM DISC
6520  2276           ISZ BUFF
6521  4541           JMS I GETWRX
6522  1051           TAD ARG2
6523  3303           DCA TEMP
6524  2053           ISZ ARG4
6525  4541           JMS I GETWRX
6526  1051           TAD ARG2
6527  6201           CDF 0
6530  3676           DCA I BUFF
6531  2276           ISZ BUFF
6532  1303           TAD TEMP         /STORE LO ORDER WORD FIRST
6533  3676           DCA I BUFF
6534  6211           CDF 10
6535  5717           JMP I GET
6536  0000  OUTPUT,  0        /PUTS SORTED TABLE ON DISC
6537  1275           TAD NUM
6540  7041           CIA
6541  3300           DCA CNTR
6542  1274           TAD OBEGIN
6543  3276           DCA BUFF
6544  1055           TAD ARG6
6545  3052  OUT,     DCA ARG3
6546  3053           DCA ARG4
6547  1676           TAD I BUFF       /GET VALUE FROM TABLE
6550  3051           DCA ARG2
6551  4520           JMS I PUTWRX
6552  2276           ISZ BUFF
6553  2300           ISZ CNTR
6554  5345           JMP OUT
6555  4757           JMS I PSWP2      /RESTORE FIELD 0
6556  5736           JMP I OUTPUT
6557  6633  PSWP2,   SWAP2
      /
6560  1314  RESET,   TAD MAX
6561  3704           DCA I PDSL
6562  1314           TAD MAX
6563  3705           DCA I PDSH
6564  5765           JMP I PGO
6565  6202  PGO,     GO
      *6100
6100  0000  DCM,     0        /DOUBLE PRECISION COMPLEMENT SIMULATES 8E EE
6101  7100           CLL
6102  7040           CMA      /ENTER WITH HI WORD IN AC
6103  3312           DCA CM   /LO IN MQ
6104  7501           MQA
6105  7041           CIA
6106  7421           MQL
6107  7004           RAL
6110  1312           TAD CM   /RETURNS WITH TWOS COMPLEMENT HI IN AC
6111  5700           JMP I DCM        /LO IN MQ
6112  0000  CM,      0
6113  0000  DADD,    0        /DOUBLE PRECISION ADD 8E EAE
```

```
6114  7100          CLL
6115  3337          DCA H1
6116  7501          MQA
6117  3336          DCA L1
6120  6211          CDF 10  /GET BACK TO FIELD 1
6121  1713          TAD I DADD      /ADDRESS OF FIELD 1 DATA
6122  3335          DCA AD
6123  1735          TAD I AD
6124  1336          TAD L1
6125  7421          MQL
6126  2335          ISZ AD
6127  7004          RAL
6130  1735          TAD I AD
6131  1337          TAD H1
6132  2313          ISZ DADD
6133  6201          CDF 0   /RESET FIELD
6134  5713          JMP I DADD
6135  0000  AD,      0
6136  0000  L1,      0
6137  0000  H1,      0
              PAUSE/
              /
              /SWAPPING ROUTINE FOR 512 STAR SORTER
              *6600
6600  0000  SWAP,   0  /SAME AS READY
6601  4245    JMS WAIT
6602  4537    JMS I BWRITX
6603  1132    TAD KILALL
6604  3230    DCA KILSAV
6605  1232    TAD KILTMX
6606  3132    DCA KILALL
6607  3126    DCA INTRUP
6610  4257    JMS ADDRES
6611  1225    TAD P2
6612  4420    JMS I DISCX  /SAVE FIELD 0 (4420)
6613  5211    JMP .-2
6614  2041    ISZ DTEST
6615  7352    CLL CLA CMA RTR
6616  3116    DCA BLOKIN
6617  1040    TAD DISEND
6620  3231    DCA DISTEM
6621  1040    TAD DISEND
6622  1226    TAD P7165
6623  3040    DCA DISEND
6624  5600    JMP I SWAP
6625  0002  P2,   2
6626  7165  P7165,   7165
6627  2000  M6000,   -6000
6630  0000  KILSAV,   0
6631  0000  DISTEM,   0
6632  6676  KILTMX,   KILTEM
6633  0000  SWAP2,   0  /RESTORES FIELD 0
6634  4257    JMS ADDRES
6635  1231    TAD DISTEM
6636  3040    DCA DISEND
6637  4420    JMS I DISCX
6640  5237    JMP .-1
6641  2041    ISZ DTEST
6642  1230    TAD KILSAV
6643  3132    DCA KILALL
```

```
6644  5633     JMP I SWAP2
6645  0000   WAIT,  0
6646  6002     IOF
6647  6201     CDF
6650  1656     TAD I TELSWX
6651  6211     CDF 10
6652  7650     SNA CLA
6653  5645     JMP I WAIT
6654  6001     ION
6655  5246     JMP WAIT+1
6656  0016   TELSWX, TELSW
6657  0000   ADDRES,  0
6660  7300     CLA CLL
6661  1227     TAD M6000
6662  3024     DCA DDWCNT
6663  1274     TAD P600
6664  3026     DCA DSFELD
6665  1275     TAD P2516
6666  3025     DCA DISADD
6667  1273     TAD P200
6670  3023     DCA DDCORE
6671  3041     DCA DTEST
6672  5657     JMP I ADDRESS
6673  0200   P200,  200
6674  0600   P600,  600
6675  2516   P2516,  2516
6676  6601   KILTEM,  DCMA
6677  4702     JMS I POUTPUT  /DUMP SORTED TABLE ONTO DISC
6700  4233     JMS SWAP2
6701  5532     JMP I KILALL
6702  6536   POUTPUT,  OUTPUT

.PUTT
SET TAPE 8 TO WRITE ENABLED.
FILE NO.(0-4):4
 FILE 4 FULL.TYPE Y TO REUSE IT :Y
DONE!
.PREP
.LOAD
*IN-S:SORT2
*
ST=
↑↑
.TOVR


SAVE(ON TAPE 7)AS OVERLAY NO.:5
TYPE I.D;PRESS RETURN:SWAP SORT 92573

OVERLAY STORED!
.
```

(84)

```
 W
C:LICK FOCAL AME73-I  IFE7

01.01 C-PROG 17
01.02 X CALL(6,1)

02.10 A !"FIRST AND LAST IMAGE NO.S",J,K
02.20 F I=J,K;DO 4
02.50 Q

04.10 T !%3 I,%5 FIN(BI,I,2),FIN(BI,I,3)

13.10 S N=0;S BT=8
13.14 X NAME(5)
13.16 X SORT(BI,0,30,BT)
13.20 S N=N+1;S I=FTAK(BT,N)
13.30 DO 4
13.50 G 13.2

20.10 F J=0,10,120;T !%3;DO 20.9
20.20 Q
20.90 F K=0,9;T FTAK(BT,J+K)

21.02 S BT=8
21.04 ASK !"NO OF STARS",N
21.06 X NAME(5)
21.10 X SORT(BI,40,N,BT)
21.30 DO 20

31.98 W
31.99 X END(0)
*
```

← WRITES OUT TABLE FROM SORT ROUTINE.

File 3 Tape 153
Dec. 12/73

(85)

```
.PALP
*CUT-S:STEP
*
*IN-S:CON0,S:GCON,S:STEP
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /STEP
                /X STEP(NX,NY,TX,TY,P,MV)+ CR - N STEPS OF LENGTH T.
                /REPEATED WITH PERIOD P,LEAVE MOVING IF MV NON ZERO.
                /
                *FINDX
0104   5312     FINDIT
                /
                *FNAB1+13
0657   0770     770      /STEP
                *KB1+13
0153   5211     STEPER
                /
                *5200
5200   0000     YTIME,0
5201   0000     XTIME,0
5202   0000     PTIME,0
5203   0000     MOTION,0
5204   0000     XMOVE,0
5205   0000     YMOVE,0
5206   0003     P3,3
5207   0004     P4,4
5210   0014     P14,14
                /
5211   0000     STEPER,0
5212   2210     XTES,ISZ ARG3H   /TEST -VE SIGN
5213   5216       JMP XPLUS      /+VE MOTION
5214   1207       TAD P4
5215   5223       JMP XSET       /-VE MOTION
5216   1052     XPLUS,TAD ARG3
5217   7450       SNA
5220   5224       JMP XPUT       /ZERO X MOTION
5221   7041       CIA
5222   3052       DCA ARG3       /USE -VE STEP COUNT IN ARG3
5223   1207     XSET,TAD P4
5224   3204     XPUT,DCA XMOVE
                /
5225   2011     YTES,ISZ ARG4B   /TEST SIGN OF Y MOTION
5226   5231       JMP YPLUS      /+VE MOTION
5227   7001       IAC
5230   5236       JMP YSET       /-VE
5231   1053     YPLUS,TAD ARG4
5232   7450       SNA
5233   5237       JMP YPUT       /ZERO Y MOTION
```

This routine is used by X JOY( ).
X STEP( ) is rarely used. (if ever!)

/ must be > TX, TY.

```
5234  7041     CIA
5235  3053     DCA ARG4
5236  7001  YSET, IAC
5237  3205  YPUT, DCA YMOVE
5240  1054  STEP, TAD ARG5
5241  7040     CMA
5242  3201     DCA XTIME
5243  1055     TAD ARG6
5244  7040     CMA
5245  3200     DCA YTIME
5246  1056     TAD ARG7
5247  7041     CIA              /TAKES ZERO AS 4096
5250  3202     DCA PTIME
5251  1204     TAD XMOVE
5252  1205     TAD YMOVE
5253  7450     SNA
5254  5310     JMP EXIT         /EXIT STOPPED
5255  3203  PULSE, DCA MOTION
5256  1203  WAIT, TAD MOTION
5257  7040     CMA              /HARDWARE IS INVERTED
5260  6733     MOVAME
5261  7300     CLA CLL
5262  1057     TAD ARG8
5263  7640     SZA CLA
5264  5310     JMP  EXIT        /EXIT MOVING
5265  2201  XSTEP, ISZ XTIME
5266  5272     JMP YSTEP
5267  1203     TAD MOTION
5270  0206     AND P3
5271  5255     JMP PULSE        /END X PULSE
5272  2200  YSTEP, ISZ YTIME
5273  5277     JMP PSTEP
5274  1203     TAD MOTION
5275  0210     AND P14
5276  5255     JMP PULSE        /END Y PULSE
5277  2202  PSTEP, ISZ PTIME
5300  5256     JMP WAIT
5301  2052     ISZ ARG3
5302  7410     SKP
5303  3204  XKILL, DCA XMOVE /NO MORE X PULSES
5304  2053     ISZ ARG4
5305  7410     SKP
5306  3205  YKILL, DCA YMOVE /NO MORE Y PULSES
5307  5240     JMP STEP         /END PERIOD
5310  4312  EXIT, JMS FINDIT
5311  5611     JMP I STEPER
           /
5312  0000  FINDIT, 0          /USED BY X MOVE(--)
5313  3052     DCA ARG3         /SELECT X
5314  4505     JMS I LOCX       /READ STAGE LOC
5315  4336     JMS TIMES        /MULTIPLY BY 2.5 FOR DISPLAY
5316  3200     DCA YTIME        /TEMP STORE
5317  7501     MQA
5320  3201     DCA XTIME        /TEMP STORE
5321  7001     IAC
5322  3052     DCA ARG3
5323  4505     JMS I LOCX       /READ Y
5324  4336     JMS TIMES
5325  3011     DCA ARG4H
5326  7501     MQA
```

- See Prog "MICR"

```
5327  3053     DCA ARG4
5330  1200     TAD YTIME
5331  3010     DCA ARG3H
5332  1201     TAD XTIME
5333  3052     DCA ARG3
5334  4507     JMS I ALOCX    /X,Y IN ARG3,ARG4
5335  5712     JMP I FINDIT
              /
5336  0000  TIMES,0
5337  1050     TAD ARG1
5340  7425     MQL!MUY
5341  0005     5
5342  7501     MQA
5343  3050     DCA ARG1
5344  1051     TAD ARG2       /LO PART
5345  7425     MQL!MUY
5346  0005     5
5347  1050     TAD ARG1       /HI PART
5350  7415     ASR
5351  0000     0              /ROTATE 1 TO DIVIDE BY 2
5352  5736     JMP I TIMES    /RESULT:HI IN AC,LO IN MQ
```

File 3 Tape 10C
Mar. 5/74

(88)

```
.PALP
*OUT-S:SURV
*
*IN-S:CON0,S:GCON,S:SURV
*
*
*
*OPT-T

ALOCX  0107

                /CON0
                XLIST
                PAUSE/
                /GCON
                XLIST
                PAUSE/
                /
                /SURV
                /S D=FSURV(N,K)-READ SURVEY POSITION..X:N=0..Y:N=1.
                /K=1 TO IGNORE DATEX HARDWARE ERRORS
                /N=-1 TO TEST SURVEY FLAG;RETURNS 0 IF FLAG OFF.
                /X DISP(N)  DISPLAY N AS STAR NUMBER IN SURVEY BOX.
                /S D=FSWTS(S,N)--READ SURVEY SWITCHES .MASK WITH N UNLESS 0.
                /S=0 TO CLEAR SURVEY FLAG
                /
                OPCODE=ARG10
                /
                *KB1+34
0174   6400     SURVEY
                *KB1+52
0212   6155     DISPLY
0213   6331     SWITCH
                *FNKB1+34
0700   1246     1246     /SURV
                *FNKB1+52
0716   0650     0650     /DISP
0717   1463     1463     /SWTS
                /
                *6155
6155   0000     DISPLY,0
6156   1052       TAD ARG3
6157   7421       MQL
6160   7407       DVI
6161   0012       12
6162   3051       DCA ARG2
6163   7407       DVI
6164   0012       12
6165   7006       RTL
6166   7006       RTL
6167   1051       TAD ARG2
6170   3051       DCA ARG2        /2ND DIGIT
6171   7413       SHL
6172   0023       23              /GET TOP DIGIT FROM RESULTANT
6173   1051       TAD ARG2
6174   7040       CMA
6175   6735       6735            /LOAD DISPLAY REGISTER
6176   7200       CLA
6177   5755       JMP I DISPLY
                /
                *6327
```

```
6327  0040  P40,40
6330  7770  P7770,7770
            /
6331  0000  SWITCH,0
6332  1052    TAD ARG3
6333  7450    SNA
6334  5374    JMP ERASOF
6335  7041    CIA
6336  3054    DCA ARG5
6337  1376    TAD P400
6340  7110    CLL RAR
6341  2054    ISZ ARG5        /SET 200,100 OR 40 IN AC
6342  5340    JMP .-2
6343  7040    CMA             /HARDWARE IS REVERSED.
6344  6733    SETSUR
6345  6737    REDSUR          /CLEARS AC,THEN READS.
6346  7040    CMA
6347  3051    DCA ARG2
6350  7344    CLA CLL CMA RAL         /SET -2
6351  1052    TAD ARG3
6352  7640    SZA CLA         /TESTING FOR SWITCHES #2
6353  5362    JMP NOFIX
6354  1051    TAD ARG2
6355  0327    AND P40
6356  7640    SZA CLA
6357  1330    TAD P7770       /CHANGE 40 TO 30 (FUNNY WIRING.
6360  1051    TAD ARG2
6361  3051    DCA ARG2
6362  1053  NOFIX,TAD ARG4
6363  7450    SNA
6364  5367    JMP MASKOK
6365  0051    AND ARG2
6366  3051    DCA ARG2        /RESULT MASKED
6367  7240  MASKOK,CLA CMA
6370  1052    TAD ARG3        /SWITCH 1 IS DECIMAL
6371  7650    SNA CLA
6372  4511    JMS I BCDBNX    /CONVERT BCD FROM SWITCH 0
6373  5731    JMP I SWITCH
            /
6374  6734  ERASOF,6734       /CLEAR SURVEY FLAG
6375  5731    JMP I SWITCH
            /
6376  0400  P400,400
            /
            *6400
6400  0000  SURVEY,0
6401  1010    TAD ARG3H
6402  7700    SMA CLA
6403  5211    JMP NOTEST
6404  6732    6732            /SKIP FOR SURVEY FLAG
6405  7410    SKP
6406  7001    IAC    /+1 FOR FLAG ON
6407  3051    DCA ARG2
6410  5600    JMP I SURVEY
6411  1052  NOTEST,TAD ARG3
6412  7110    CLL RAR         /1 FOR Y
6413  1372    TAD P2000
6414  7430    SZL
6415  7112    CLL RTR         /400 FOR Y
6416  3061    DCA OPCODE
```

```
6417  3377     DCA LOWTES
6420  1061     TAD OPCODE
6421  7040     CMA
6422  6733     SETSUR          /SELECT SURVEY INPUT
6423  6737     REDSUR
6424  7040     CMA
6425  3050     DCA ARG1
6426  1061     TAD OPCODE
6427  7104     CLL RAL
6430  7040     CMA
6431  6733     SETSUR
6432  6737     REDSUR          /READ LO PART
6433  7040     CMA
6434  3051     DCA ARG2
6435  3347     DCA SSIGN       /PRESET FOR CONVERSION
6436  1051     TAD ARG2
6437  7421     MQL
6440  4304     JMS CONVER      /TOP 4 BITS
6441  7112     CLL RTR
6442  7012     RTR
6443  7010     RAR             /BCD IN TOP DIGIT
6444  3051     DCA ARG2
6445  4304     JMS CONVER      /CONVERT 2ND DIGIT
6446  7106     CLL RTL
6447  7006     RTL
6450  1051     TAD ARG2
6451  3051     DCA ARG2
6452  2377     ISZ LOWTES      /ALLOW FOR LOW DIGIT ERRORS
6453  4304     JMS CONVER      /CONVERT LOW DIGIT
6454  3377/05/ DCA LOWTES      /NOW CLEAR IT
6455  1051 3051 TAD ARG2
6456  3051 3377 DCA ARG2
6457  3347     DCA SSIGN       /NOW DO HI DIGIT 2ND WORD
6460  1051     TAD ARG2
6461  1303     TAD M2400       /BCD 500
6462  7710     SPA CLA
6463  5300     JMP LAG
6464  1050 LEAD,TAD ARG1
6465  7012     RTR
6466  7012     RTR             /'LEAD' IN 2ND DIGIT SPACE
6467  0302 GODO,AND P17
6470  7112     CLL RTR
6471  7012     RTR
6472  7010     RAR
6473  7421     MQL             /4 BITS TO TOP OF MQ
6474  4304     JMS CONVER
6475  3050     DCA ARG1        /RESULT IS NOW IN BCD
6476  4511     JMS I BCDBNX    /RESULT NOW IN BINARY
6477  5600     JMP I SURVEY
               /
6500  1050 LAG,TAD ARG1
6501  5267     JMP GODO
               /
6502  0017 P17,17
6503  5400 M2400,-2400
               /
6504  0000 CONVER,0
6505  7413     SHL
6506  0003     3
6507  3350     DCA TEMP
```

```
6510  1347    TAD SSIGN       /TEST PARITY OF PRECEEDING DIGIT
6511  7700    SOA CLA
6512  5321    JMP EVEN
6513  1350    TAD TEMP
6514  7112    CLL RTR
6515  7012    RTR
6516  7026    CML RTL         /COMPLEMENT DATEX BIT 'D'
6517  7006    RTL
6520  7410    SKP
6521  1350  EVEN,TAD TEMP
6522  1351    TAD LIST
6523  3350  DOIT,DCA TEMP
6524  1750    TAD I TEMP      /CONVERTED DIGIT FROM TABLE
6525  7012    RTR
6526  3347    DCA SSIGN       /PARITY FOR NEXT DIGIT
6527  1053    TAD ARG4
6530  7110    CLL RAR         /LINK =1 TO IGNORE ERRORS
6531  1750    TAD I TEMP
6532  7500    SMA
6533  5704    JMP I CONVER
6534  7420    SNL
6535  5340    JMP ERROR
6536  7200    CLA             /A DATEX ERROR BUT GO ON
6537  5704    JMP I CONVER
6540  7300  ERROR,CLA CLL
6541  1377    TAD LOWTES
6542  7640    SZA CLA
6543  5373    JMP LOWDIG      /LOWEST DIGIT,MAY SHOW ERROR IN X.
6544  7240    CLA CMA
6545  3050    DCA ARG1        /KILL,WITH -VE OUT FOR OTHER ERRORS
6546  5600    JMP I SURVEY
              /
6547  0000  SSIGN,0
6550  0000  TEMP,0
6551  6552  LIST,ZERO
6552  7777  ZERO,-1
6553  0000  ONE,0
6554  0002  TWO,2
6555  0001  THREE,1
6556  0004  FOUR,4
6557  7777  FIVE,-1
6560  0003  SIX,3
6561  7777  SEVEN,-1
6562  7777  EIGHT,-1
6563  0011  NINE,9
6564  0007  TEN,7
6565  0010  ELEVEN,8
6566  0005  TWELVE,5
6567  7777  THRTEN,-1
6570  0006  FORTEN,6
6571  7777  FIFTEN,-1
              /
              /
6572  2000  P2000,2000
              /
6573  1350  LOWDIG,TAD TEMP
6574  1376    TAD M5          /X ENCODER READS 7 FOR 2,AND 15 FOR 10.
6575  5323    JMP DOIT
              /
6576  7773  M5,-5
6577  0     LOWTES,0
```

(92)

File 3 Tape 15B
Oct 2/73.

```
.PALP
*OUT-S:SWIT
*
*IN-S:CON0,S:SWIT,S:JOY1,S:JOY2
*
*
*
*
*OPT-T

APOINT 6554

                /CON0
                XLIST
                PAUSE/
                /
                /SWIT--FOR MEM. SCOPE 613
                /S D=FSWIT(SW,SH,X,Y,M,Q);IF SW -VE,ERASE CRT
                /IF SW 0,LOAD LIGHTS FROM SH
                /..FSWIT(3,10,X,Y,0,Q) RETURNS 1024*X+Y WHEN SWITCH
                /3,10 IS PUSHED. IF Q NON ZERO,SWITCH CAN
                /BE HELD ON FOR FAST REPETITION
                /M IS A MASK IF NON-ZERO
                /
                /
                CODLOD=6361
                READSW=6362
                LITSET=6367
                ERASE=6362
                /
                *KB1+12
0152    6422    SWITCH
                *FNKB1+12
0656    1334    1334    /SWIT
                /
                XMOVE=17
                YMOVE=16
                XTEMP=15
                /
                *6422
6422    0000    SWITCH,0
6423    1052        TAD ARG3
6424    7700        SMA CLA
6425    5231        JMP OK
6426    1325        TAD P16
6427    6361        CODLOD          /SET GATE FOR ERASE
6430    6362      ERASE
6431    1053    OK,TAD ARG4
6432    7450        SNA
6433    7001        IAC             /ALLOW 0 SHIFT READOUT FOR SH=0
6434    3317        DCA SHIFT
6435    1054        TAD ARG5
6436    3050        DCA ARG1
6437    1055        TAD ARG6
6440    7440        SZA
6441    5254        JMP JOYCAL
6442    1052        TAD ARG3
6443    7650        SNA CLA
6444    5250        JMP LIGHTS
6445    4300        JMS SWTRED
6446    3051        DCA ARG2
6447    5622        JMP I SWITCH
```

```
                /
6450   1053     LIGHTS,TAD ARG4
6451   6367        LITSET
6452   7200        CLA
6453   5622        JMP I SWITCH
                /
6454   3051     JOYCAL,DCA ARG2 /INITIAL MARK LOCATION
6455   1057       TAD ARG8
6456   7650       SNA CLA
6457   4300       JMS SWTRED
6460   7640       SZA CLA
6461   5257       JMP .-2          /WAIT TILL SWITCH OFF UNLESS ARG8 SET
6462   4727     JOYTES,JMS I JOYSTX
6463   4300        JMS SWTRED
6464   7650        SNA CLA
6465   5262        JMP JOYTES      /SWITCH NOT CLOSED
6466   1051        TAD ARG2        /CONVERT TO 1024*X+Y
6467   7106        CLL RTL         /FROM 4096*X+Y
6470   7421        MQL
6471   1050        TAD ARG1
6472   7417        LSR
6473   0001        1
6474   3050        DCA ARG1
6475   7501        MQA
6476   3051        DCA ARG2
6477   5622        JMP I SWITCH
                /
6500   0000     SWTRED,0
6501   1052        TAD ARG3
6502   6361        CODLOD          /SELECT SWITCH GROUP
6503   7041        CIA
6504   3017        DCA 17
6505   1326        TAD P17
6506   7110     MVMASK,CLL RAR  /GENERATE MASK
6507   2017        ISZ 17
6510   5306        JMP MVMASK
6511   3324        DCA MASK        /3 BITS FOR 1,2 FOR 2,1 FOR 3
6512   1056        TAD ARG7
6513   7440        SZA
6514   3324        DCA MASK
6515   6362        READSW
6516   7417        LSR
6517   0000     SHIFT,0
6520   7413        SHL
6521   0001        1
6522   0324        AND MASK
6523   5700        JMP I SWTRED
                /
6524   0000     MASK,0
6525   0016     P16,16
6526   0017     P17,17
6527   6600     JOYSTX,JOYSTK
                PAUSE/
                /
                /JOY1
                /
6530   0000     ARMAKE,0        /DRAW A DIAMOND
6531   3015        DCA XTEMP
6532   1375        TAD P2
6533   3017        DCA XMOVE
```

```
6534  1375      TAD P2
6535  3016      DCA YMOVE
6536  4351      JMS DIAGON
6537  1373      TAD M2
6540  3016      DCA YMOVE
6541  4351      JMS DIAGON
6542  1373      TAD M2
6543  3017      DCA XMOVE
6544  4351      JMS DIAGON
6545  1375      TAD P2
6546  3016      DCA YMOVE
6547  4351      JMS DIAGON
6550  5730      JMP I ARMAKE
                /
6551  0000    DIAGON,0
6552  1376      TAD M4
6553  3374      DCA COUNTA
6554  1015    APOINT,TAD XTEMP
6555  1017      TAD XMOVE
6556  6053      DXL
6557  3015      DCA XTEMP
6560  7501      MQA
6561  1016      TAD YMOVE
6562  6063      DYL
6563  7421      MQL
6564  6014      RFC
6565  6014      RFC
6566  6014      RFC   /DELAY FOR SCOPE SETTLING
6567  6362      BRITEN
6570  2374       ISZ COUNTA
6571  5354       JMP APOINT
6572  5751       JMP I DIAGON
                /
6573  7776    M2,-2
6574  0000    COUNTA,0
6575  0002    P2,2
6576  7774    M4,-4
                PAUSE/
                /
                /JOY2
                /MOVES A MARKER FOR THE JOYSTICK
                /
                CODLOD=6361
                BRITEN=6362
                XJOY=6363
                YJOY=6364
                SKPJOY=6365
                /
                COUNTM=ARG9
                SIGN=ARG10
                *6600
6600  0000    JOYSTK,0
6601  1275      TAD P26       /SET BRITEN
6602  6361      CODLOD
6603  7200      CLA
6604  6363      XJOY
6605  1050      TAD ARG1
6606  4307      JMS MOVER     /READ JOYSTICK
6607  0000    XADDER,0
6610  3050      DCA ARG1      /X TO ARG1,Y TO ARG2
```

```
6611  1233      TAD XSET
6612  3252      DCA MLINE
6613  1051      TAD ARG2
6614  6063  YSET, DYL
6615  4301      JMS JSETUP
6616  1050      TAD ARG1
6617  4247      JMS LINER
6620  7450      SNA
6621  5223      JMP XDISP
6622  4774      JMS I ARMAKX /X IN AC, Y IN MQ
6623  6364  XDISP, YJOY
6624  1051      TAD ARG2
6625  4307      JMS MOVER
6626  0000  YADDER, 0
6627  3051      DCA ARG2
6630  1214      TAD YSET
6631  3252      DCA MLINE
6632  1050      TAD ARG1
6633  6053  XSET, DXL
6634  4301      JMS JSETUP
6635  1051      TAD ARG2
6636  4247      JMS LINER
6637  7450      SNA
6640  5246      JMP ENDIT
6641  1277      TAD P6
6642  7421      MQL
6643  1050      TAD ARG1
6644  1273      TAD M10
6645  4774      JMS I ARMAKX
6646  5600  ENDIT, JMP I JOYSTK
            /
6647  0000  LINER, 0
6650  3031      DCA TEMPS0
6651  1031      TAD TEMPS0
6652  0000  MLINE, 0          /DYL OR DXL
6653  6014      RFC            /DELAY
6654  6014     RFC
6655  6014     RFC    /FAST PAPER TAPE IOT-UNUSED!
6656  1300     TAD PP3
6657  6362      BRITEN
6660  2060      ISZ COUNTM
6661  5252      JMP MLINE
6662  7200      CLA
6663  1061      TAD SIGN
6664  7450      SNA
6665  5647      JMP I LINER
6666  7700      SMA CLA
6667  1272      TAD P110
6670  1031  AROCAL, TAD TEMPS0
6671  5647      JMP I LINER
            /
6672  0110  P110, 110
6673  7770  M10, -10
6674  7744  M34, -34
6675  0026  P26, 26
6676  7726  M52, -52
6677  0006  P6, 6
6700  0003  PP3, 3
            /
6701  0000  JSETUP, 0
```

```
6702  7421      MQL
6703  1274      TAD M34
6704  3060      DCA COUNTM
6705  1276      TAD M52
6706  5701      JMP I JSETUP
                /
6707  0000  MOVER,0
6710  3301      DCA JSETUP    /TEMPORARY STORE
6711  7240      CLA CMA
6712  3061      DCA SIGN
6713  7330      CLA STL RAR
6714  7450  TIME1,SNA
6715  5322      JMP ZEROED
6716  7010      RAR
6717  6365      SKPJOY
6720  5314      JMP TIME1     /MEASURING TIME DELAY
6721  5332      JMP DONE
6722  3061  ZEROED,DCA SIGN
6723  7004  TIME2,RAL
6724  7510      SPA
6725  7050      CMA RAR
6726  6365      SKPJOY
6727  5323      JMP TIME2
6730  3061      DCA SIGN
6731  1061      TAD SIGN
6732  7450  DONE,SNA
6733  3061      DCA SIGN
6734  7100      CLL
6735  1707      TAD I MOVER
6736  3707      DCA I MOVER
6737  7430      SZL
6740  5347      JMP STEP
6741  1707      TAD I MOVER
6742  1371      TAD M400
6743  7700      SMA CLA
6744  5347      JMP STEP
6745  2307  LEAVE,ISZ MOVER
6746  5367      JMP EXIT
                /
6747  3707  STEP,DCA I MOVER        /CLEAR ADDER
6750  2307      ISZ MOVER
6751  1061      TAD SIGN
6752  7710      SPA CLA
6753  7144      CLL CMA RAL  /-2
6754  7001      IAC  /+ OR -1 TO ARG1 OR ARG2 IF ADDER OVERFLOWS
6755  1301      TAD JSETUP
6756  7510      SPA
6757  7200      CLA
6760  3301  SAVIT,DCA JSETUP        /MOVE MARK CENTER
6761  1301      TAD JSETUP
6762  0373      AND P6000
6763  7650      SNA CLA
6764  5367      JMP EXIT
6765  1372      TAD P1777
6766  5360      JMP SAVIT
6767  1301  EXIT,TAD JSETUP
6770  5707      JMP I MOVER
                /
6771  7400  M400,-400
6772  1777  P1777,1777
6773  6000  P6000,6000
6774  6530  ARMAKX,ARMAKE
                /
```

File 3 Tape 15A
May 30/73

(97)

```
.PALP
*OUT-S:SWTA
*
*IN-S:CON0,S:GCON,S:SWTA
*
*
*
*OPT-T

AMFG 01  6724

                 /CON0
                 XLIST
                 PAUSE/
                 /GCON
                 XLIST
                 PAUSE/
                 /
                 /SWTA                    AME control
                 /S D=FSWTA(M) READ SWITCHES, MASKED BY M
                 /
                 *FNKB1+31
0675   1441      1441      /SWTA
                 *KB1+31
0171   6721      SWITCH
                 /
                 *6720
6720   0021      P21,21
                 /
6721   0000      SWITCH,0
6722   1320        TAD P21
6723   7040        CMA
6724   6723        SETAME
6725   6727        READAM
6726   7040        CMA              /HARDWARE IS INVERTED
6727   3051        DCA ARG2
6730   1052        TAD ARG3
6731   7450        SNA
6732   5721        JMP I SWITCH
6733   0051        AND ARG2
6734   3051        DCA ARG2
6735   5721        JMP I SWITCH

.
```

(98)

June 14/73
Same as "TAPE" but for overlay #4

```
.PALP
*OUT-S:TAPO
*
*IN-S:CON0,S:TAPO
*
*
*OPT-T

ADDRES 6350

                /CON0
                XLIST
                PAUSE/
                /
                /TAPO
                /COPIES  TO TAPE FROM DISC AND BACK
                /X MPUT(D,T,N,U) COPIES N BLOCKS DISC TO TAPE  STARTING
                /AT DISC BLOCK D AND TAPE BLOCK T,UNIT U.
                /X MTAK(D,T,N,U) TAPE TO DISC!
                /USES TAPE FROM BLOCK 500
                /DISC BLOCKS 213-225 ARE LOST
                /
                /
                *KB1+64
0224  6400      MPUT
0225  6412      MTAK
                /
                *FNKB1+64
0730  2574    2574    /MPUT
0731  2723    2723    /MTAK
                /
                *6350
6350  0000    ADDRES,0          /FOR SAVING FIELD 0
6351  3024      DCA DDWCNT      /WORD COUNT IN AC.
6352  1363       TAD P600
6353  3026       DCA DSFFLD
6354  1362       TAD P5655
6355  3025       DCA DISADD
6356  1764      TAD I P200X
6357  3023       DCA DDCORE
6360  3041      DCA DTEST        /ALLOW WRITING IN PROTECTED AREA
6361  5750       JMP I ADDRES
                /
6362  5655    P5655,5655        /SAVES 6300 WORDS FOR OVERLAY+3617 HERE.
6363  0600    P600,600
6364  6533    P200X,P200
                /
6365  0000    WAIT,0
6366  6002      IOF
6367  6201      CDF
6370  1776      TAD I TELSWX    /PROTECTING AGAINST 'TYPE' TURNING  ION.
6371  6211      CDF 10
6372  7650      SNA CLA
6373  5765      JMP I WAIT
6374  6001      ION
6375  5366      JMP WAIT+1
                /
6376  0016    TELSWX,TELSW
                /
                /
```

```
                PAGE
6400  0000      MPUT,0
6401  4226        JMS READY
6402  4311      WXFER,JMS SETLNG
6403  4420      DISRED,JMS I DISCX
6404  5203          JMP .-1       /DISC ERROR
6405  1037          TAD P20
6406  4421          JMS I DTAPX
6407  5203          JMP DISRED    /TAPE ERROR
6410  4274          JMS ADVANCE
6411  5202          JMP WXFER
                /
6412  0000      MTAK,0
6413  1212          TAD MTAK
6414  3200          DCA MPUT
6415  4226          JMS READY
6416  4311      RXFER,JMS SETLNG
6417  4421      DISWRT,JMS I DTAPX
6420  5217          JMP .-1
6421  1335          TAD P2        /NOW WRITE DISK
6422  4420          JMS I DISCX
6423  5217          JMP DISWRT    /ERROR
6424  4274          JMS ADVANCE
6425  5216          JMP RXFER
                /
6426  0000      READY,0
6427  4770        JMS I TWAITX  /FINISH TYPING.
6430  4537        JMS I BWRITX  /BE SURE LAST BLOCK IS ON DISK
6431  1132          TAD KILALL
6432  3342          DCA KILSAV
6433  1344          TAD KILTMX
6434  3132          DCA KILALL    /SET TEMPORARY EXIT FOR ERROR
6435  3126        DCA INTRUP      /LOCK INTERRUPT OFF
6436  1332        TAD M3617
6437  4745          JMS I ADRESX
6440  1335          TAD P2
6441  4420          JMS I DISCX   /SAVE FIELD 0
6442  5240          JMP .-2       /ERROR
6443  2041        ISZ DTEST       /RESTORE DISK PROTECT.
6444  1331          TAD P500
6445  1053          TAD ARG4
6446  3027          DCA DTBLCK
6447  1055          TAD ARG6
6450  7112          CLL RTR
6451  7012          RTR
6452  3030          DCA DTUNIT
6453  1052        TAD ARG3
6454  4512        JMS I DCSETX  /SETS DISC ADDRESS
6455  7352        CLL CLA CMA RTR
6456  3116        DCA BLOKIN    /DISK MAY GET CHANGED.
6457  1040        TAD DISEND
6460  3343        DCA DISTEM
6461  1040        TAD DISEND
6462  1340        TAD P100
6463  3040        DCA DISEND    /PROTECT EXTRA 2K FOR FIELD 0
6464  1026          TAD DSFELD
6465  0341          AND P700
6466  3026          DCA DSFELD  /FIELD 0
6467  1332          TAD M3617   /17 OCTAL BLOCKS
6470  3024          DCA DDWCNT
```

```
6471  1333     TAD P200
6472  3023      DCA DDCORE
6473  5626      JMP I READY
                /
6474  0000  ADVANCE,0
6475  7300      CLL CLA
6476  1025      TAD DISADD
6477  1334      TAD P3617
6500  3025      DCA DISADD
6501  7430      SZL
6502  1076      TAD P100
6503  1026      TAD DSFELD
6504  3026      DCA DSFELD
6505  1337      TAD P17
6506  1027      TAD DTBLOK
6507  3027      DCA DTBLOK
6510  5674      JMP I ADVANCE
                /
6511  0000  SETLNG,0
6512  1054      TAD ARG5
6513  7450      SNA
6514  5353      JMP EXIT      /ALL DONE
6515  1336      TAD M17
6516  7510      SPA
6517  5322      JMP LAST
6520  3054  EXSET,DCA ARG5
6521  5711      JMP I SETLNG
6522  1337  LAST,TAD P17
6523  7425      MQL!MUY
6524  0201      201
6525  7701      CLA!MQA
6526  7041      CIA
6527  3024      DCA DDVCNT
6530  5320      JMP EXSET
6531  0500  P500,500
6532  4161  M3617,-3617
6533  0200  P200,200
6534  3617  P3617,3617
6535  0002  P2,2
6536  7761  M17,-17
6537  0017  P17,17
6540  0104  P104,104        /PROTECTS DISC AFTER BLOCK 209
6541  0700  P700,700
6542  0000  KILSAV,0
6543  0000  DISTEM,0
                /
6544  6546  KILTMX,KILTEM
6545  6350  ADRESX,ADDRES
                /
6546  6601  KILTEM,DCMA
6547  1030     TAD DTUNIT
6550  6766     DTCA!DTXA     /KILL FLAGS
6551  4355     JMS RECOVR
6552  5532      JMP I KILALL
                /
6553  4355  EXIT,JMS RECOVR
6554  5600      JMP I MPUT
                /
6555  0000  RECOVR,0
6556  1332     TAD M3617
```

```
6557  4745      JMS I ADRESX
6560  1343      TAD DISTEM
6561  3040      DCA DISEND    /NORMAL DISC AREA AGAIN
6562  4420      JMS I DISCX   /RESTORE FIELD 0
6563  5362      JMP .-1
6564  2041     ISZ DTEST      /RESTORE DISC PROTECT.
6565  1342      TAD KILSAV
6566  3132      DCA KILALL
6567  5755      JMP I RECOVR
               /
6570  6365  TWAITX=WAIT
               /
```

File 2 Tape 109
July 22/73.

(102)

```
.PALP
*OUT-S:TOTL
*
*IN-S:CON0,S:TOTL
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /TOTL
                /S D=FTOTL(B,W,N)-TOTALS WORDS ON THE DISC
                /FOR MICROPHOTOMETER.
                /
                TEMPL=ARG10
                TEMPH=ARG9
                /
                *KB1+51
0211    6112    TOTAL
                *FNKB1+51
0715    1454    1454    /TOTL
                *6112
6112    0000    TOTAL,0
6113    1054      TAD ARG5
6114    7041      CIA
6115    3054      DCA ARG5
6116    3060      DCA TEMPH
6117    3061      DCA TEMPL
6120    4541    NEXT, JMS I GETWRX
6121    3052      DCA ARG3
6122    3053      DCA ARG4        /GET SUCCESSIVE WORDS
6123    7300      CLL CLA
6124    1051      TAD ARG2
6125    1061      TAD TEMPL
6126    3061      DCA TEMPL
6127    7004      RAL             /GET CARRY
6130    1060      TAD TEMPH
6131    3060      DCA TEMPH
6132    2054      ISZ ARG5
6133    5320      JMP NEXT
6134    1061      TAD TEMPL
6135    3051      DCA ARG2
6136    1060      TAD TEMPH
6137    3050      DCA ARG1
6140    5712      JMP I TOTAL
```

(103)

Nov. 23/72

```
.PALP
*OUT-S:VAR
*
*IN-S:CON0,S:VAR
*
*
*OPT-T

ARG1    0050

                /CON0
                XLIST
                PAUSE/
                /
                /VAR
                /S D=FVAR(0);RECORDS LAST VARIABLE POSITION
                /X VAR(D) ERASES VARIABLES PAST LOC. D
                *FNKB1+63
0727    2132    2132    /VAR
                *KB1+63
0223    6151    VARFIX
                *6151
6151    0000    VARFIX,0
6152    6201    CDF
6153    1775      TAD I LASVRX
6154    6211      CDF 10
6155    3051      DCA ARG2
6156    1052      TAD ARG3
6157    7450      SNA
6160    5751      JMP I VARFIX
6161    1376      TAD M3200
6162    7710      SPA CLA
6163    5532      JMP I KILALL  /BELOW  3200-ILLEGAL
6164    1052      TAD ARG3
6165    1377      TAD M4600
6166    7700      SMA CLA
6167    5532      JMP I KILALL  /ABOVE 4600-ILLEGAL
6170    1052      TAD ARG3
6171    6201      CDF
6172    3775      DCA I LASVRX
6173    6211      CDF 10
6174    5751      JMP I VARFIX
                /
6175    0031    LASVRX,LASTV    /LAST VARIABLE IN FOCAL
6176    4600    M3200,-3200
6177    3200    M4600,-4600
```