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AN AUTOMATED HUMAN FACTORS ANALYSIS SYSTEM FOR IMAGING
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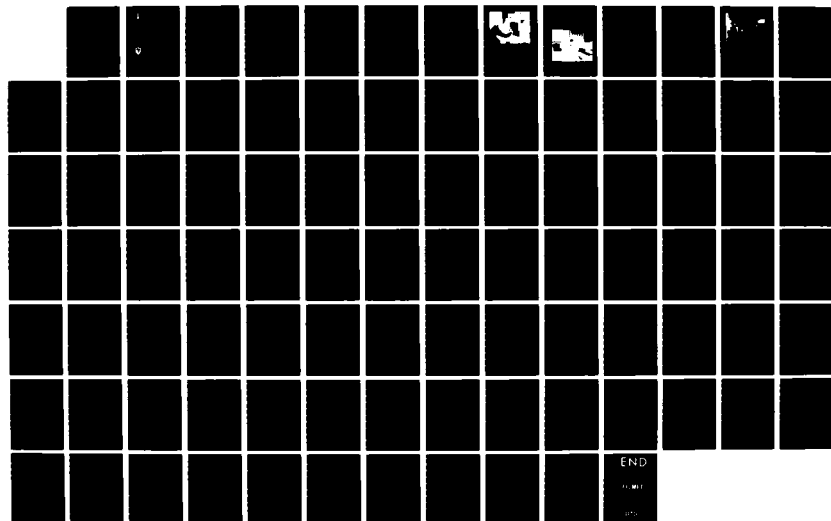
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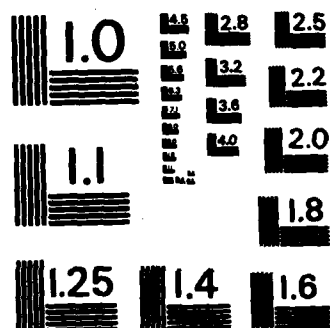
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TECHNICAL REPORT RE-83-24

**AN AUTOMATED HUMAN FACTORS ANALYSIS SYSTEM
FOR IMAGING DATA**

S. Richard Sims
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Advanced Sensors Directorate
US Army Missile Laboratory

APRIL 1983



U.S. ARMY MISSILE COMMAND

Redstone Arsenal, Alabama 35898

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An automated human factors data collection system for imaging devices is described. This REAL-TIME collection system permits an operator to view images and react according to system requirements. Results are accumulated and stored in a VAX-11/780 computer for further processing. Target designator/cuer hardware and tracker interface circuitry designs are included. Computer program listings and sample results for a Fiber Optic Guided Missile (FOG-M) experiment are provided.		

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I. INTRODUCTION

This report describes an automated human factors data collection system for imaging devices which produce composite video. Some of the types of information available for analysis after data collection are shown in Appendix G. The system replays tapes of actual sensor video or from any other synthetic source onto a CRT screen to allow the operator to react according to individual system requirements. In general, the minimum ground truth required for each composite video data set is as follows:

1. Range IRIG time correlated with video
2. Sensor position on the range correlated with IRIG time
3. All target positions on the range correlated with IRIG time

The Fiber Optic Guided Missile (FOG-M) program instigated the design and development of this system, therefore examples will be used that relate directly to FOG-M.

II. MAN MACHINE INTERFACE

The man machine interface has always been an area of concern for systems where work load is operator intensive. In systems where an operator is required to view a CRT screen to locate targets some form of hand controller is typically used for designation. Instead of using a "joystick" or track-ball, a touch screen was used in this system to minimize the operator error and to "filter" out as many operator differences as possible. Two different types of touch screens were used in preliminary operator tests and both are available for data collection.

The first type of touch screen, the Elograph Model 270,* is a pressure sensitive type which covers the CRT screen. This touch screen allows the operator to use a ball point pen or similar stylus or his finger to designate a point on the screen.

The second type of touch screen, the Science Accessories Corporation Model GP-650,** is a sonic type which can be mounted to almost anything. With this touch screen the operator uses a pen to designate objects in the active area defined by an L frame sensor. The L frame can be sized for the application at the factory if needed.

-
1. Elographics Inc. 1976 Oak Ridge Turnpike, Oak Ridge, Tennessee 37830, (615) 482-4038
 2. Science Accessories Corp. 970 King's Highway West, Southport, Connecticut 06490, (203) 255-1526



Figure 1. Touch screen used for the FOG-M human factors data collection.

TANK	APC	TRUCK	JEEP	RESET
M60	M113			
M48	LANCE CARRIER			
M551				

Figure 2. Target types in the FOG-M data set.

The operator station shown in Figures 3 and 4 contains:

1. An appropriate CRT display with attached touch screen.
2. Video tape player for the video source.
3. Computer terminal for controlling data collection.
4. IRIG time translator.
5. Computer interface for real time IRIG time transfer.
6. Dedicated cueing hardware to provide operator feedback and cuer testing.

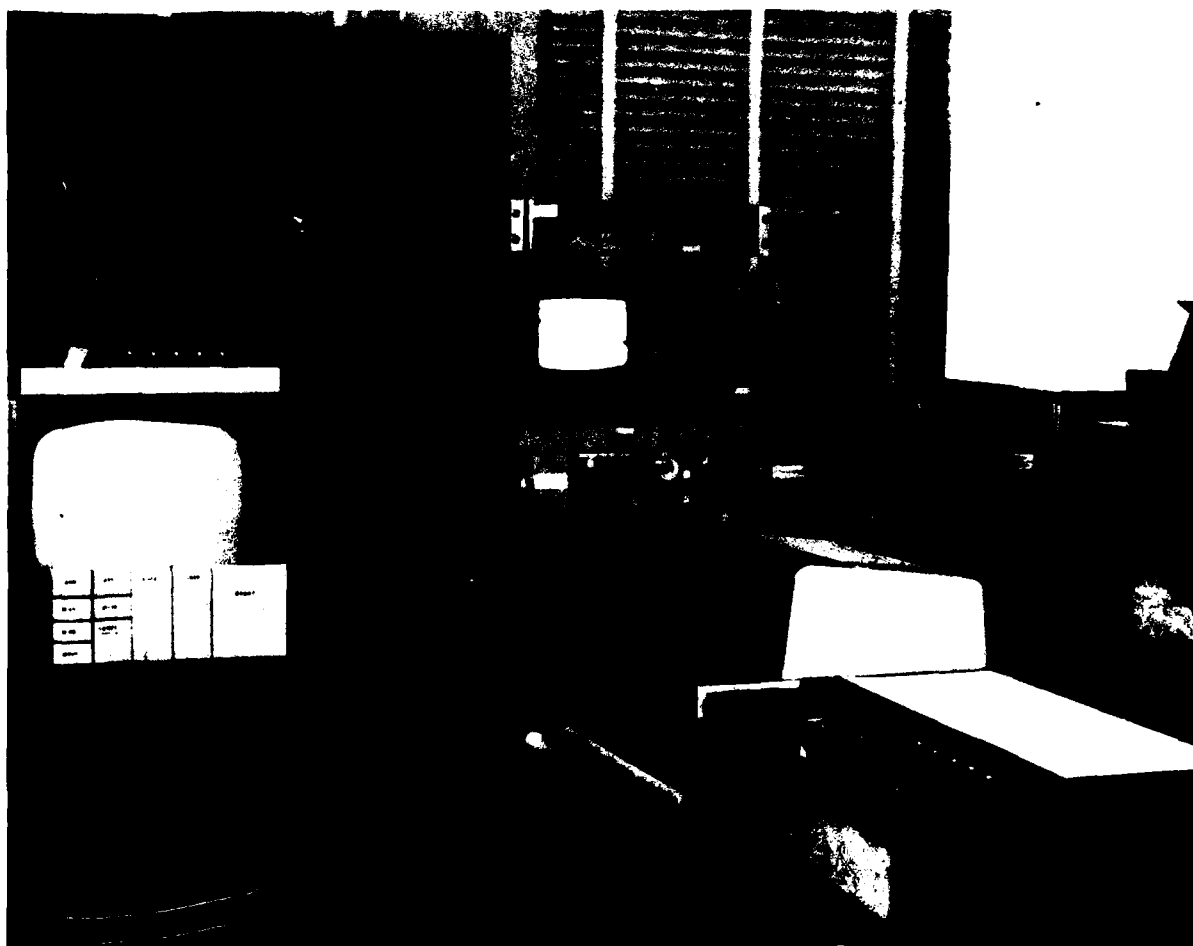


Figure 3. Operator station.

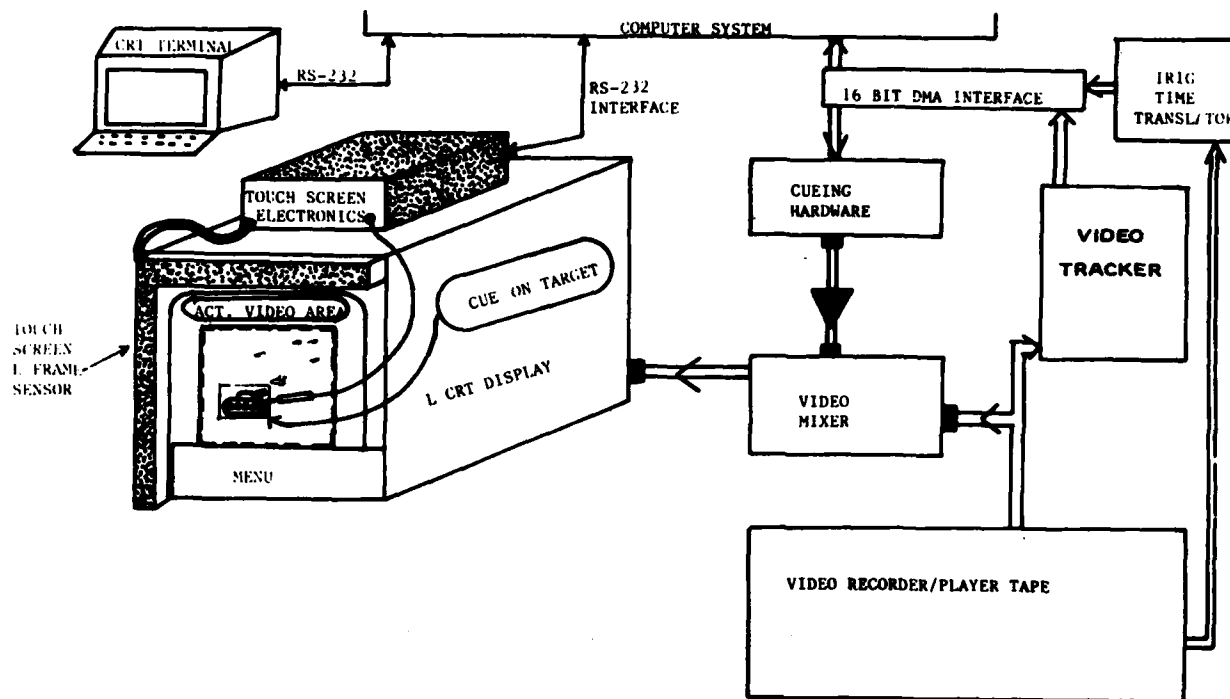


Figure 4. Operator station schematic.

III. DATA COLLECTION

Prior to beginning a data collection experiment, the operators should be given a standard briefing and allowed some finite amount of training before actually starting the experiment. Specific tasks expected of the operator should be carefully defined for the scenario under consideration. In the FOG-M application experiment, video imagery from an airborne camera flown at speeds and altitudes approximating the FOG missile trajectory was used to assess the ability of operators to find military targets such as tanks, trucks, jeeps and armored personnel carriers (APC), situated at various locations on the test ranges at Redstone Arsenal. Military and civilian personnel were selected to serve as the system operators. After a formal briefing which included descriptions of the various targets and the techniques to be used to designate the targets, each individual was placed at the operator station for familiarization with the video imagery, touch screen and the menu board. Operators were instructed to observe the display and touch the screen with the probe when (1) they discovered what might be a target, and (2) when they detected it to be an actual target. When the operators recognized the target class (tank, truck, etc.), they touched the appropriate menu area. If they were able to identify the type of tank (M60, M48, M551) or APC (M113 or Lance carrier), the menu was again used. A reset area on the menu was also available for error corrections. For each operator response the following information was stored:

1. Touch screen x coordinate
2. Touch screen y coordinate

3. IRIG time of the designation

4. Customized menu designation

Appendix A contains a listing of the data collection program used for the FOG-M operator. All responses from each operator are stored separately in individual files on a mass storage hard disk. From this information and a knowledge of the ground truth, the operators were scored on their ability to detect, recognize, and identify these targets.

IV. GROUND TRUTH GENERATION

The composite video was played back and individual targets were tracked with a video tracker in real time for ground truth generation. A program listing for the ground truth data collection program is in Appendix C. A hardware description of the tracker interface to the computer is described in Appendix F. Each target ground truth file is combined with the other target ground truths for an individual sequence on the analog tape. Some editing or additional ground truth was required on video sequences with large image movement. Each sequence of combined ground truth was then played back with ground truth cues around all targets to evaluate ground truth completeness using the program in Appendix D. The picture in Figure 5 shows an output of several cues displayed during the running of the program in Appendix D. All ground truth sequences are then sorted into one file for use by the data reduction program.

An alternate method for ground truth generation is to judiciously digitize the analog data, and on each frame, or every few frames, and where the target is virtually stationary, use those coordinates for that specific IRIG time. This later process is clearly more time consuming, but in video scenes where large accelerations and jerks are prevalent, perhaps it is the better method.

V. DATA REDUCTION AND ANALYSIS

To make the analysis as significant as possible and to minimize the statistical error, as many samples (i.e., operators) as can be generated should be used for the data collection. All individual operator results were combined into one file for input to the data reduction program. Optionally, and in addition, after each operator data run was completed, the data reduction program can be run to show the individual operator results. Appendix B contains the FOG-M data reduction program listing. The aircraft position as obtained from Mini-Ranger* data and surveyed target locations were used by the data reduction program to calculate range to target, depression angles, etc. This information was then correlated with the seeker or camera video through the common IRIG time recording. Appendix G shows the FOG-M results over the entire combined data set including all altitudes and flight directions. More specific plots and printouts of the individual altitude runs and grouped data runs have provided more detailed information, and clearly this type of

*Mini-Ranger is a trademark of Motorola, Inc., Government Electronics Division, Scottsdale, Arizona 85257.

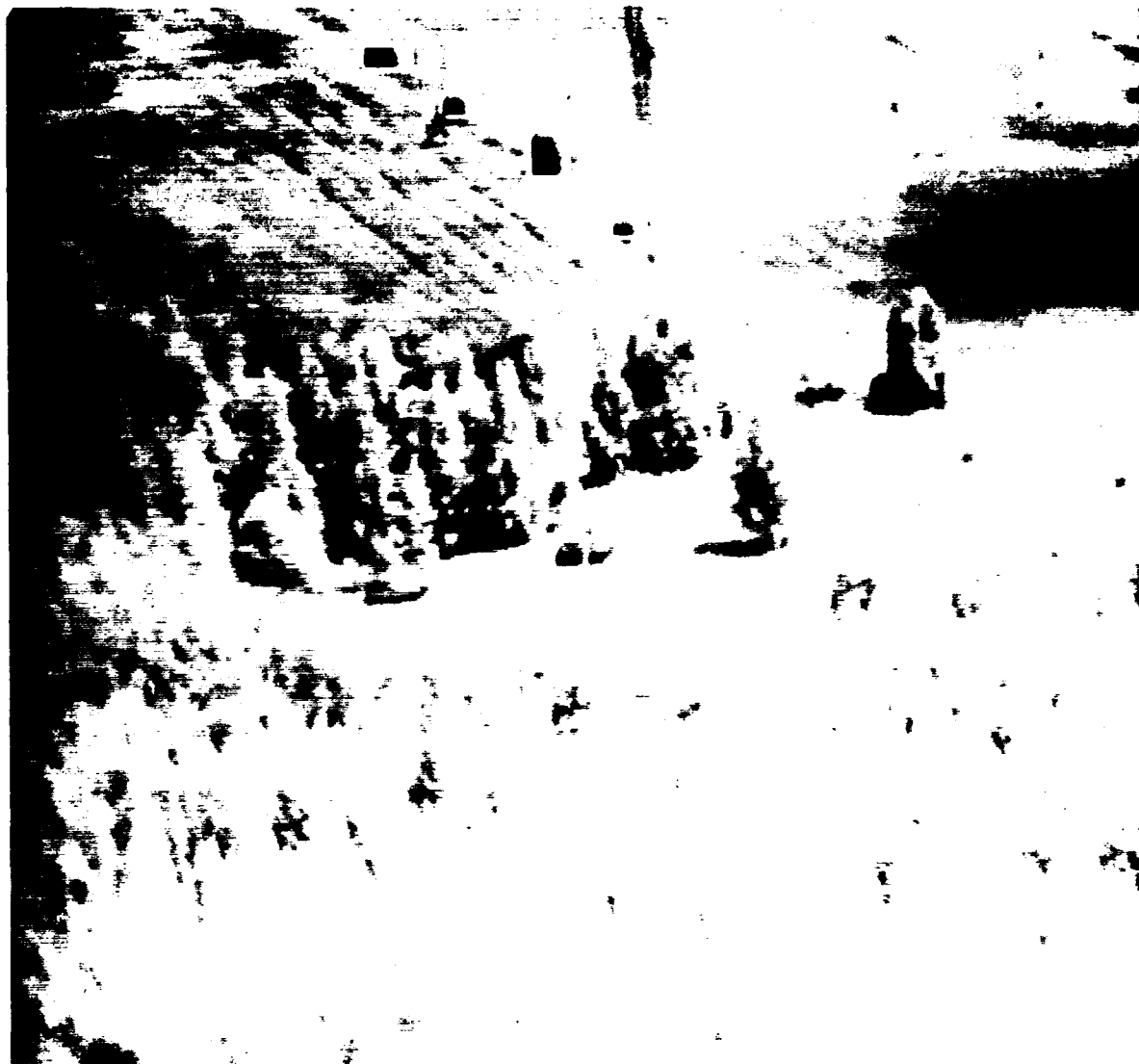


Figure 5. Picture of output of several cues displayed during the running of the program presented in Appendix D.

grouping for each specific system type will be needed to provide the detailed results needed. For complete FOG-M final data reduction and analysis results see Reference 1.

VI. CUEING HARDWARE AND EVALUATING CUEING SYSTEM PERFORMANCE

The cueing hardware is capable of generating up to ten simultaneous cues. Each cue is in the form of a box with each side independently positioned by the computer to any point on the screen. The screen resolution for the cues is 256 by 256. The intensity of the first four cues can be varied and the number one cue can be optionally "blinked."

The cueing hardware adds the additional capability of being able to evaluate automatic cuer performance. By using ground truth and adding false cues to simulate the known performance of any specific automatic cueing system operator performance can then be evaluated versus his non-cued performance. This type of evaluation will provide a means for cost/performance trade offs. Appendix E shows the cueing hardware schematics along with a definition of input/output signals. Appendix F shows and explains the computer interface hardware for use with the cueing hardware, tracker, and touch screen.

VII. PLANNED IMPROVEMENTS

A voice recognition unit will be included in the system to augment and perhaps to replace the menu on the touch screen. The intent is to allow the operator to speak the words "tank," jeep," APC," truck," or "reset" instead of having to look at and touch the menu itself. Also, a digital tracker will be included to help in ground truth generation.

VIII. CONCLUSIONS

An automated human factors analysis system for imaging data has been designed and fabricated. The equipment and computer program for the data reduction and analysis have been tested in an application requiring the detection, recognition, and identification of military targets using 26 different operators and will be used with extended data sets for the same application. How the video imagery is collected clearly will influence whether or not operator responses have any significance to the "REAL WORLD." Imagery collected to closely simulate true system parameters is obviously desirable, along with all available ground truth for the data set. The objective of this system is to show what system parameter trade-offs could be made to keep system performance at some desirable level. It is clear that analysis of operator responsivity under specific conditions can lead to reasonable system parameters which will keep overall system performance as high as possible.

APPENDIX A

FOG-M DATA COLLECTION PROGRAM USED FOR THE OPERATOR


```

56 ISTATUS=SYS$ASSIGN('TTB',TECHAN..)
57 IF(.NOT.ISTATUS)TYPE = ' ERROR IN TTB CHANNEL ASSIGN'
58 IFLAG=1
59 INLOCK(1)=XLOC(BOXES(1))
60 INLOCK(2)=XLOC(BOXES(48))
61 K=SYS$BLKSET(INLOCK,ILOCK,)
62 IF(.NOT.K)TYPE = ' UNABLE TO LOCK BOXES I/O BUFFER'
63 INLOCK(1)=XLOC(IRIG(1))
64 INLOCK(2)=XLOC(IRIG(6))
65 K=SYS$BLKSET(INLOCK,ILOCK,)
66 IF(.NOT.K)TYPE = ' UNABLE TO LOCK IRIG I/O BUFFER'
67 INLOCK(1)=XLOC(STRINGS(1:1))
68 INLOCK(2)=XLOC(STRINGS(16:16))
69 K=SYS$BLKSET(INLOCK,ILOCK,)
70 IF(.NOT.K)TYPE = ' UNABLE TO LOCK IRIG I/O BUFFER'
71 OPEN(UNIT=5,NAME='TT',STATUS='OLD')
72 TYPE = ' ENTER VIDEO TAPE NUMBER BEING VIEWED(TAPE 1 OR 2)'
73 READ(5,55)IVIDEOT
74
58 FORMAT(I1)
75 OPEN(UNIT=12,NAME='OPERATOR.FOB',TYPE='NEW')
76 WRITE(12,66)IVIDEOT
77
56 FORMAT(1X,'TAPE NUMBER ',I1,' FOR-M OPERATOR DATA FOLLOWS')
78 C K=SYS$ASCTIM(.TIME,..)
79 TYPE = ' TEST THE TOUCH SCREEN FOR I/O ENABLED.....'
80 K = SYS$QIOV(EVAL(1),EVAL(TECHAN),
81 2EVAL(XLOC(IOS_READVBLK).OR.XLOC(IOSM_NOECHO)),
82 IOSB,..,DATA,EVAL(16),...)
83 TYPE = ' TOUCH SCREEN NOW READY FOR OPERATOR INPUT.',
84 1' IS IRIG UNIT IN TRANSLATE??'
85 C
86 XORIGIN=5.6
87 YORIGIN=5.62
88 VORIGIN=4.67
89 XS=28.48
90 VS=24.8
91 XD=XS-XORIGIN
92 YD=YS-YORIGIN
93 CALL UIO
94 CONTINUE
95 K=SYS$HIBER()
96 GO TO 1
97 END
98 SUBROUTINE UIO
99 BYTE C
100 EXTERNAL IOS_READVBLK,IOSM_NOECHO
101 EXTERNAL INPUT
102 INTEGER SYS$ASSIGN,SYS$QIOV,ITCHAN,SYS$QIO,XRCHAN
103 INTEGER IOS_READVBLK,IOSM_NOECHO,TECHAN
104 CHARACTER*15 STRING
105 BYTE DATA(16)
106 INTEGER*2 IOSB(4)
107 EQUIVALENCE(DATA,STRING)
108 COMMON/CHAN/ITCHAN,XRCHAN,TECHAN
109 COMMON/DINIT/XD,YD,XORIGIN,YORIGIN
110 COMMON/STRNG/STRING
111 COMMON/FLAG/IORIGIN,IMAXY

```



```

166      TH=IAND(IRIG(1),'2'X)
167      UN=ISHFT(IRIG(2),-12)
168      TM=IAND(ISHFT(IRIG(2),-9),'7'0)
169      UM=IAND(ISHFT(IRIG(2),-5),'F'X)
170      TS1=IAND(ISHFT(IRIG(2),-2),'7'0)
171      ISAVE(1)=IAND(ISHFT(IRIG(2),2),'C'X)
172      ISAVE(2)=ISHFT(IRIG(3),-14)
173      US=IOR(ISAVE(1),ISAVE(2))
174      TS2=IAND(ISHFT(IRIG(3),-15),'F'X)
175      LS=IAND(ISHFT(IRIG(3),-6),'F'X)
176      MS=IAND(ISHFT(IRIG(3),-2),'F'X)
177      IDAY=155*ND+15*TD+UD
178      IN=TM*15+UN
179      IM=TM*15+UM
180      SEC=FLOAT(TS1*15+US)+FLOAT(TS2)/15.+FLOAT(LS)/155.
181      I=FLOAT(MS)/1555.
182      755 K=SYS$WAITFR(ZVAL(5))
183      IF(.NOT.K)TYPE=,' ERROR ON WAITFR IN AST ROUTINE. 06'
184      DECODE(14,751,STRING,ERR=772)X,Y
185      751 FORMAT(1X,F6.2,2X,F6.2)
186      I
187      C CONTINUE
188      WRITE(6,19)X,Y,XD,XORIGIN,VORIGIN
189      19 FORMAT(' X=',F6.2,' Y=',F6.2,' XD=',F6.2,' XORIGIN=',F6.2,
190      1' VORIGIN=',F6.2)
191      IF(X-XORIGIN.EQ.0.0)THEN
192      X=0.0
193      GO TO 23
194      ENDIF
195      IF(Y-VORIGIN.EQ.0.0)THEN
196      Y=0.0
197      GO TO 25
198      ENDIF
199      X=254./((XD/(X-XORIGIN)))
200      Y=242./((YD/(Y-VORIGIN)))
201      GO TO 25
202      23 IF(Y-VORIGIN.NE.0.0)THEN
203      Y=242./((YD/(Y-VORIGIN)))
204      ELSE
205      Y=0.0
206      ENDIF
207      C WRITE(6,18)X,Y,XD,XORIGIN,VORIGIN
208      18 FORMAT(' X=',F15.2,' Y=',F15.2,' XD=',F6.2,' XORIGIN=',F6.2,
209      1' VORIGIN=',F6.2)
210      C 245.-253.-8. WHICH ARE THE MAX X AND MIN X VISIBLE OF THE BOX
211      C 241.-253.-12. WHICH ARE THE MAX Y AND MIN Y VISIBLE OF THE BOX
212      25 IF(Y.GT.254.)THEN
213      IF(X.GE.98..AND.X.LT.167.)THEN
214      WRITE(12,61)X,Y,IDAY,IN,IN,SEC
215      WRITE(6,61)X,Y,IDAY,IN,IN,SEC
216      61 FORMAT(1X,F6.2,1X,F6.2,5X,12,' ',12,' ',12,' ',F6.2,
217      1' TRUCK RECOGNITION')
218      GO TO 26
219      ENDIF
220      IF(X.GE.167..AND.X.LT.297.)THEN
221      WRITE(12,62)X,Y,IDAY,IN,IN,SEC

```

```

221      WRITE(6,62)X,Y,IDAY,IN,IN,SEC
222 62   FORMAT(1X,F6.2,1X,F6.2,5X,13,' ',12,' ',12,' ',F6.2,
223      1' JEEP RECOGNITION')
224      GO TO 26
225      ENDIF
226      IF(X.GE.237.)THEN
227      X=255.
228      Y=255.
229      WRITE(12,63)X,Y,IDAY,IN,IN,SEC
230      WRITE(6,63)X,Y,IDAY,IN,IN,SEC
231 63   FORMAT(1X,F6.2,1X,F6.2,5X,13,' ',12,' ',12,' ',F6.2,
232      1' ***** RESET *****')
233      GO TO 26
234      ENDIF
235      IF(V.LT.396.)THEN
236      IF(X.LT.27.)THEN
237      WRITE(12,60)X,Y,IDAY,IN,IN,SEC
238      WRITE(6,60)X,Y,IDAY,IN,IN,SEC
239 50   FORMAT(1X,F6.2,1X,F6.2,5X,13,' ',12,' ',12,' ',F6.2,
240      1' TANK RECOGNITION')
241      GO TO 26
242      ENDIF
243      IF(X.GE.27..AND.X.LT.94.7)THEN
244      WRITE(12,60)X,Y,IDAY,IN,IN,SEC
245      WRITE(6,60)X,Y,IDAY,IN,IN,SEC
246 60   FORMAT(1X,F6.2,1X,F6.2,5X,13,' ',12,' ',12,' ',F6.2,
247      1' APC RECOGNITION')
248      GO TO 26
249      ENDIF
250      ENDIF
251      IF(V.GE.396..AND.V.LT.354)THEN
252      IF(X.LT.27.)THEN
253      WRITE(12,64)X,Y,IDAY,IN,IN,SEC
254      WRITE(6,64)X,Y,IDAY,IN,IN,SEC
255 64   FORMAT(1X,F6.2,1X,F6.2,5X,13,' ',12,' ',12,' ',F6.2,
256      1' M60 IDENTIFICATION')
257      GO TO 26
258      ENDIF
259      IF(X.GE.27..AND.X.LT.94.7)THEN
260      WRITE(12,66)X,Y,IDAY,IN,IN,SEC
261      WRITE(6,66)X,Y,IDAY,IN,IN,SEC
262 66   FORMAT(1X,F6.2,1X,F6.2,5X,13,' ',12,' ',12,' ',F6.2,
263      1' M113 IDENTIFICATION')
264      GO TO 26
265      ENDIF
266      ENDIF
267      IF(V.GE.354..AND.V.LT.396.)THEN
268      IF(X.LT.27.)THEN
269      WRITE(12,66)X,Y,IDAY,IN,IN,SEC
270      WRITE(6,66)X,Y,IDAY,IN,IN,SEC
271 66   FORMAT(1X,F6.2,1X,F6.2,5X,13,' ',12,' ',12,' ',F6.2,
272      1' M48 IDENTIFICATION')
273      GO TO 26
274      ENDIF
275      IF(X.GE.27..AND.X.LT.94.7)THEN

```

```

276 WRITE(12,67)X,V,IBAY,IN,IN,SEC
277 WRITE(6,67)X,V,IBAY,IN,IN,SEC
278 67 FORMAT(1X,F8.2,1X,F8.2,5X,12,'',12,'',12,'',F6.2,
279 1' LANCE CARRIER IDENTIFICATION')
280 GO TO 26
281 ENDIF
282 ENDIF
283 IF(Y.GE.396.)THEN
284 IF(X.LT.27.)THEN
285 WRITE(12,68)X,V,IBAY,IN,IN,SEC
286 WRITE(6,68)X,V,IBAY,IN,IN,SEC
287 68 FORMAT(1X,F8.2,1X,F8.2,5X,12,'',12,'',12,'',F6.2,
288 1' MISSILE IDENTIFICATION')
289 GO TO 26
290 ENDIF
291 IF(X.GE.27..AND.X.LT.94.7)THEN
292 WRITE(12,67)X,V,IBAY,IN,IN,SEC
293 WRITE(6,67)X,V,IBAY,IN,IN,SEC
294 C LANCE CARRIER ID AGAIN
295 GO TO 26
296 ENDIF
297 ENDIF
298 ENDIF
299 WRITE(12,56)X,V,IBAY,IN,IN,SEC
300 WRITE(6,56)X,V,IBAY,IN,IN,SEC
301 56 FORMAT(1X,F8.2,1X,F8.2,5X,12,'',12,'',12,'',F6.2,
302 1' OBJECT OR TARGET DESIGNATION')
303 26 BOXES(1)=5
304 BOXES(2)=5
305 BOXES(3)=5
306 BOXES(4)=5
307 BOXES(5)=X-1.
308 IF(BOXES(5).LT.5)BOXES(5)=IAND(BOXES(5),'377'0)
309 IF(BOXES(5).LT.1)BOXES(5)=1
310 IF(BOXES(5).GT.254)BOXES(5)=254
311 BOXES(6)=X-1.
312 IF(BOXES(6).LT.5)BOXES(6)=IAND(BOXES(6),'377'0)
313 IF(BOXES(6).GT.254)BOXES(6)=254
314 BOXES(7)=Y-1.
315 IF(BOXES(7).LT.5)BOXES(7)=IAND(BOXES(7),'377'0)
316 IF(BOXES(7).LT.1)BOXES(7)=1
317 IF(BOXES(7).GT.242)BOXES(7)=242
318 BOXES(8)=Y-1.
319 IF(BOXES(8).LT.5)BOXES(8)=IAND(BOXES(8),'377'0)
320 IF(BOXES(8).GT.242)BOXES(8)=242
321 C WRITE(6,151)BOXES(5),BOXES(6),BOXES(7),BOXES(8)
322 151 FORMAT(1X,4(2X,06))
323 K=SYS$WAITFR(XVAL(4))
324 IF(.NOT.K)TYPE=,' ERROR ON WAITFR IN AST ROUTINE, #4'
325 K = SYS$QIO(XVAL(4),XVAL(XRCHAN),XVAL(XLOC(108_WRITEVBLK)),
326 1108B,...,BOXES(1),XVAL(85),...)
327 155 CONTINUE
328 CALL UIO
329 RETURN
330 772 TYPE =,' ERROR IN DECODE OF THE DIGITIZER OUTPUT'

```

```
331      K = SYSIOIO(EVAL(S),EVAL(TECHAN),EVAL(ZLOC(LOS_READVBLK)),IOSS,  
332      1.,  
333      2 DATA(1),EVAL(15),...)  
334      GO TO 700  
335      END
```

APPENDIX B

FOG-M DATA REDUCTION PROGRAM LISTING


```

56      COMMON/TANKS/XTANK(13),YTANK(13),ITOTALY
57      C      ALTS(1) ARE THE 325 AND 335 RUNS
58      C      ALTS(2) ARE THE 555      RUNS
59      C      ALTS(3) ARE THE 825 AND 835 RUNS
60      C      ALTS(4) ARE THE RUNS NOT COVERED BY 1,2, OR 3
61      DATA ALTS/4*5/,ALTT/325,555,825/
62      DATA XTANK/1795.,1748.,1713.,1773.,1825.,1974.5,2025.5,2073.2,
63      12125.,973.,973.,973.,973./
64      DATA YTANK/-25.,-115.,-155.,-175.,-145.,-123.,-123.,-123.,
65      1-227.,-276.,-235.,-195./
66      CALL GTRUTH(IDAY,IN,IN,SEC,X,Y,VALID,ITARGETN)
67      C      TYPE *, ' ENTER FILE NAME.(100. OPERATOR.TOT)'
68      C      READ(5,56)NAME
69      56      FORMAT(A)
70
71      NAME='1.ATVS1OPERATOR.TOT'
72
73      OPEN(UNIT=12,NAME=NAME,TYPE='OLD',READONLY,SHARED)
74      1212      FORMAT('5')
75      NAME1='MINI.DAT'
76      TYPE *, ' READING UNFORMATTED MINI RANGER DATA FROM FILE ',NAME1
77      OPEN(UNIT=9,NAME=NAME1,TYPE='OLD',FORM='UNFORMATTED',
78      ISHARED,READONLY)
79      IL=5
80      565      READ (9,END=4555,ERR=545) IDAY,IN,IN,SEC,X,Y,Z
81      C      WRITE(6,155)IN,IN,SEC,X,Y,Z
82      155      FORMAT(1X,12,' ',12,' ',F6.3,3X,3(F9.1,1X))
83      IL=IL+1
84      IF(IL.GT.MEM1)
85      ITYPE *, ' ERROR IN ARRAY DIMENSIONS. MAKE MEM1 BIGGER IL=',IL
86      TIDAY(IL)=IDAY
87      TIN(IL)=IN
88      TIM(IL)=IN
89      TSEC(IL)=SEC
90      TX(IL)=X
91      TY(IL)=Y
92      TZ(IL)=Z
93      GO TO 565
94      545      TYPE *, ' ERROR ON KINGAIR MINIRANGER DATA READ ',IDAY,IN
95      STOP
96      4555      TYPE *,IL,' MINI RANGER DATA READ SO LETS GET ON WITH IT.'
97      C      READ(12,57)TAPE
98      57      FORMAT(A)
99      C      TYPE *,TAPE
100
101      WTANKR=5
102      WAPCR=5
103      WTRUCKR=5
104      WJEEPR=5
105      VM55ID=5
106      VM48ID=5
107      VM113ID=5
108      VM551ID=5
109      VLANCEID=5
110      NOPER=5
111      INDELTAO=5

```

```

111 INDELTAB=#
112 INDELTAR=#
113 INDELTAI=#
114 IDCOUNT=#
115 DELTAB=#.#
116 DELTABS=#.#
117 IRCOUNT=#
118 DELTAR=#.#
119 DELTARS=#.#
120 IICOUNT=#
121 DELTAI=#.#
122 DELTAIS=#.#
123 FRECOGF=#
124 FALSEIDF=#
125 FRECOG=#
126 FALSEID=#
127 TANKR=#
128 APCR=#
129 TRUCKR=#
130 JEEPR=#
131 M6SID=#
132 M4SID=#
133 M113ID=#
134 LANCEID=#
135 M561ID=#
136 RESETS=#
137 IOPIN=#
138 DTIME=777777.
139 RTIME=777777.
140 1 READ(12,68,ERR=7676,END=777)X,Y,IDAY,INN,IMM,SEC,TEXT
141 IOPIN=IOPIN+1
142 68 FORMAT(1X,F8.2,1X,F8.2,5X,13,1X,12,1X,12,1X,F6.2,A)
143 C WRITE(6,68)X,Y,IDAY,INN,IMM,SEC,TEXT
144 CALL STRUTH(IDAY,INN,IMM,SEC,X,Y,VALID,ITANKI)
145 CODE=TEXT(2:3)
146 IDSEARCH=INDEX(TEXT,'IDENT')
147 IF(.NOT.VALID)THEN
148 C WRITE(6,68)X,Y,IDAY,INN,IMM,SEC,TEXT
149 GO TO 1
150 ENDF
151 CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
152 C
153 C RESET ERROR IN OPERATOR.FOR FIX. OPERATOR.FOR HAS ALSO BEEN FIXED
154 C
155 IF(CODE.EQ.'JE'.AND.X.EQ.255..AND.Y.EQ.255.)CODE='*'
156 CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
157 IF(CODE.EQ.'*')THEN
158 RESETS=RESETS+1
159 C ITANKI=#
160 GO TO 1
161 ENDF
162 IF(ITANKI.EQ.#.AND.VALID.EQ.3)THEN
163 IF(IDSEARCH.EQ.#)THEN
164 FRECOGF=FRECOGF+1
165 ELSE

```

```

166                                     FALSEIDF=FALSEIDF+1
167                                     ENDIF
168                                     GO TO 1
169                                     ENDIF
170                                     TIME =FLOAT(IDAY-215)*60.*60.*60.+
171                                     IFLOAT(IMM)*60.*60.+FLOAT(IMM)*60.*SEC
172                                     C      WRITE(6,610)X,Y,IDAY,IMM,SEC,TEXT,ITANKI
173                                     610    FORMAT(1X,F8.2,1X,F8.2,5X,13,1X,I2,1X,I2,1X,F6.2,A,6X,I2)
174                                     IF(CODE.EQ.'08')THEN
175                                     C      TYPE =,' VALID TARGET DETECTION'          |*****
176                                     INDELTAD=INDELTAD+1
177                                     INDELTAD=INDELTAD+1
178                                     C      TYPE=,' INDELTA=',INDELTA,' ITANKI=',ITANKI,' TIME=',TIME
179                                     ITANKID(INDELTAD)=ITANKI
180                                     INDELTAD(INDELTAD)=TIME
181                                     IF(ABS(TIME-DTIME).LT.10.)THEN
182                                     DELTAD=DELTAD+(TIME-DTIME)
183                                     DELTADS=DELTADS+(TIME-DTIME)**2
184                                     IDCOUNT=IDCOUNT+1
185                                     ENDIF
186                                     DTIME=TIME          | TARGET DETECT TIME
187                                     IDDAY=IDAY
188                                     GO TO 1
189                                     ENDIF
190                                     IF(CODE.EQ.'TA'.OR.CODE.EQ.'AP'.OR.CODE.EQ.'TR'.OR.CODE.EQ.'JE')THEN
191                                     IF(IDSEARCH.NE.S)GO TO 10
192                                     RTIME=TIME
193                                     C      TYPE =,' VALID TARGET RECOGNITION'          |*****
194                                     ENDIF
195                                     IF(CODE.EQ.'TA')THEN
196                                     IF(ITANKI.EQ.2.OR.
197                                     1      ITANKI.EQ.3.OR.
198                                     1      ITANKI.EQ.4.OR.
199                                     1      ITANKI.EQ.5.OR.
200                                     1      ITANKI.EQ.10.OR.
201                                     1      ITANKI.EQ.11.OR.
202                                     1      ITANKI.EQ.12.OR.
203                                     1      ITANKI.EQ.13)THEN
204                                     INDELTAR=INDELTAR+1
205                                     INDELTAR(INDELTAR)=TIME
206                                     TANKR=TANKR+1
207                                     ELSE
208                                     WTANKR=WTANKR+1
209                                     GO TO 11
210                                     ENDIF
211                                     GO TO 2
212                                     ENDIF
213                                     IF(CODE.EQ.'AP')THEN
214                                     IF(ITANKI.EQ.1.OR.
215                                     1      ITANKI.EQ.8.OR.
216                                     1      ITANKI.EQ.9)THEN
217                                     INDELTAR=INDELTAR+1
218                                     INDELTAR(INDELTAR)=TIME
219                                     APCR=APCR+1
220                                     ELSE

```

```

221          WAPCR=WAPCR+1
222          GO TO 11
223          ENDIF
224      GO TO 2
225  ENDIF
226      IF(CODE.EQ.'TR')THEN
227          IF(ITANK1.EQ.7)THEN
228              INDELTAR=INDELTAR+1
229              INDELTAR(INDELTAR)=TIME
230              TRUCKR=TRUCKR+1
231          ELSE
232              WTRUCKR=WTRUCKR+1
233              GO TO 11
234          ENDIF
235      GO TO 2
236  ENDIF
237      IF(CODE.EQ.'JE')THEN
238          IF(ITANK1.EQ.6)THEN
239              INDELTAR=INDELTAR+1
240              INDELTAR(INDELTAR)=TIME
241              JEEPR=JEEPR+1
242          ELSE
243              WJEEPR=WJEEPR+1
244              GO TO 11
245          ENDIF
246      GO TO 2
247  ENDIF
248      GO TO 10
249  2      IF(ABS(TIME-DTIME).LT.10.)THEN
250          DELTAR=DELTAR+(TIME-DTIME)
251          ITANKIR(INDELTAR)=ITANK1
252          IRCOUNT=IRCOUNT+1
253          DELTARS=DELTARS+(TIME-DTIME)**2
254      ENDIF
255      GO TO 1
256  11      FRECOG=FRECOG+1
257  C      FALSE RECOGNITION OF AN ACTUAL TARGET
258      GO TO 1
259  10      IF(CODE.EQ.'M6'.OR.CODE.EQ.'M4'.OR.CODE.EQ.'M5'.OR.CODE.EQ.
260      1'M1'.OR.CODE.EQ.'LA')THEN
261      ENDIF
262      IF(CODE.EQ.'M6')THEN
263          IF(ITANK1.EQ.2)THEN
264              M6SID=M6SID+1
265              INDELTAI=INDELTAI+1
266              INDELTAI(INDELTAI)=TIME
267          ELSE
268              WM6SID=WM6SID+1
269              GO TO 12
270          ENDIF
271      GO TO 3
272  ENDIF
273      IF(CODE.EQ.'M4')THEN
274          IF(ITANK1.EQ.5.OR.
275          1      ITANK1.EQ.10.OR.

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276      1          ITANKI.EQ.11.OR.
277      1          ITANKI.EQ.12.OR.
278      1          ITANKI.EQ.13)THEN
279          INDELTAI=INDELTAI+1
280          NDELTAI(INDELTAI)=TIME
281          M48ID=M48ID+1
282          ELSE
283          WM48ID=WM48ID+1
284          GO TO 12
285          ENDIF
286      GO TO 3
287      ENDIF
288      IF(CODE.EQ.'M5')THEN
289          IF(ITANKI.EQ.3.OR.
290          1          ITANKI.EQ.4)THEN
291              INDELTAI=INDELTAI+1
292              NDELTAI(INDELTAI)=TIME
293              M55ID=M55ID+1
294              ELSE
295              WM55ID=WM55ID+1
296              GO TO 12
297              ENDIF
298      GO TO 3
299      ENDIF
300      IF(CODE.EQ.'M1')THEN
301          IF(ITANKI.EQ.1.OR.
302          1          ITANKI.EQ.8)THEN
303              INDELTAI=INDELTAI+1
304              NDELTAI(INDELTAI)=TIME
305              M113ID=M113ID+1
306              ELSE
307              WM113ID=WM113ID+1
308              GO TO 12
309              ENDIF
310      GO TO 3
311      ENDIF
312      IF(CODE.EQ.'LA')THEN
313      C      TYPE = 'CODE=' , CODE , ' ITANK=' , ITANKI
314          IF(ITANKI.EQ.9)THEN
315              INDELTAI=INDELTAI+1
316              NDELTAI(INDELTAI)=TIME
317              LANCEID=LANCEID+1
318              ELSE
319              WLANCEID=WLANCEID+1
320              GO TO 12
321              ENDIF
322      GO TO 3
323      ENDIF
324      GO TO 15
325      3      IF(ABS(TIME-RTIME).LT.15.)THEN
326          DELTAI=DELTAI+(TIME-RTIME)
327          ITANKI(INDELTAI)=ITANKI
328          IICOUNT=IICOUNT+1
329          DELTAIS=DELTAI*(TIME-RTIME)**2
330      ENDIF

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331      GO TO 1
332      FALSEID=FALSEID+1
333      C      WRONG IDENTIFICATION OF ACTUAL TARGET
334      GO TO 1
335      15      TYPE = CODE
336      STOP ' ERROR ON CODE '
337      777      CONTINUE
338      IOPIN=IOPIN-NOPER
339      WRITE(6,37676)TANKR,WTANKR,APCR,WAPCR,TRUCKR,VTRUCKR,JEEPR,WJEEPR,
340      1M6#ID,VM6#ID,M48ID,WM48ID,M551ID,VM551ID,M113ID,WM113ID,
341      1LANCEID,VLANCEID,
342      2RESETS,NOPER,IOPIN
343      37676      FORMAT(1X,'NUMBER OF CORRECT TANK RECOGNITIONS=',15,4X,
344      1'WRONG=',15,/,
345      1      1X,'NUMBER OF CORRECT APC RECOGNITIONS=',15,4X,
346      2'WRONG=',15,/,
347      2      1X,'NUMBER OF CORRECT TRUCK RECOGNITIONS=',15,4X,
348      3'WRONG=',15,/,
349      3      1X,'NUMBER OF CORRECT JEEP RECOGNITIONS=',15,4X,
350      4'WRONG=',15,/,
351      4      1X,'NUMBER OF CORRECT M6# IDENTIFICATIONS=',15,1X,
352      4'WRONG=',15,/,
353      5      1X,'NUMBER OF CORRECT M48 IDENTIFICATIONS=',15,1X,
354      5'WRONG=',15,/,
355      6      1X,'NUMBER OF CORRECT M551 IDENTIFICATIONS=',15,1X,
356      6'WRONG=',15,/,
357      7      1X,'NUMBER OF CORRECT M113 IDENTIFICATIONS=',15,1X,
358      7'WRONG=',15,/,
359      8      1X,'NUMBER OF CORRECT LANCE IDENTIFICATIONS=',15,1X,
360      8'WRONG=',15,/,
361      9      1X,'NUMBER OF RESETS=',15,/,
362      1      1X,'NUMBER OF OPERATORS=',15,/,
363      1      1X,'NUMBER OF TOTAL OPERATOR RESPONSES=',15,1)
364      WRITE(6,47676)FRECOT,FALSEID,FRECOTF,FALSEIDF
365      47676      FORMAT(1X,
366      1'NUMBER OF WRONG TARGET RECOGNITIONS ON ACTUAL TARGETS=',
367      115,/,
368      2      1X,
369      1'NUMBER OF WRONG TARGET IDENTIFICATIONS ON ACTUAL TARGETS=',
370      315,/,
371      4      1X,'NUMBER OF FALSE TARGET RECOGNITIONS ',115,/,
372      5      1X,'NUMBER OF FALSE TARGET IDENTIFICATIONS=',115)
373      WRITE(6,17676)IFSEQ4,IFSEQ13,IFSEQ17,(11,SEQS(11),11-1,10),SEQS(19)
374      17676      FORMAT(1X,' DESIGNATIONS FOR FALSE TARGET SEQUENCE 4=',15,/,
375      1      1X,' DESIGNATIONS FOR NO TARGET SEQUENCE 13=',15,/,
376      2      1X,' DESIGNATIONS FOR NO TARGET SEQUENCE 17=',15,/,
377      3      10(1,1X,' SEQUENCE ',12,' DESIGNATION COUNT=',115),
378      4      1X,'OUTSIDE GROUND TRUTH IRIG=',115)
379      IF(IDCOUNT.EQ.0)THEN
380      TYPE = ' NO DETECTIONS '
381      GO TO 1556
382      ENDIF
383      DELTADD=DELTAD/Float(IDCOUNT)
384      IF(IDCOUNT.EQ.1)THEN
385      WRITE(6,912)DELTAD

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386          912      FORMAT(1X,'DETECT TIME FOR THE SINGLE DETECTION=',F7.3)
387          GO TO 1856
388          ENDIF
389          SD=SQRT((DELTADS-(FLOAT(IDCOUNT)*DELTADD**2))/(FLOAT(IDCOUNT)-1.#))
390          WRITE(6,555)DELTADD,IDCOUNT,SD
391          555      FORMAT(1X,'MEAN DETECT TIME=',F7.3,1X,'SECONDS',1X,
392          1'ON',15,' DETECTIONS',/,1X,'WITH A STANDARD DEVIATION OF',
393          2F7.3)
394          1856      IF(IRCOUNT.EQ.#)THEN
395          TYPE *, ' NO RECOGNITIONS'
396          GO TO 1857
397          ENDIF
398          DELTARR=DELTAR/FLOAT(IRCOUNT)
399          IF(IRCOUNT.EQ.1)THEN
400          WRITE(6,913)DELTAR
401          913      FORMAT(1X,'RECOGNITION TIME FOR SINGLE RECOGNITION=',F7.3)
402          GO TO 1857
403          ENDIF
404          SD=SQRT((DELTARS-(FLOAT(IRCOUNT)*DELTARR**2))/(FLOAT(IRCOUNT)-1.#))
405          WRITE(6,556)DELTARR,IRCOUNT,SD
406          556      FORMAT(1X,'MEAN RECOGNITION TIME=',F18.3,1X,'SECONDS',1X,
407          1'ON',17,' TARGETS',/,1X,'WITH A STANDARD DEVIATION OF',
408          2F18.3)
409          1857      IF(IICOUNT.EQ.#)THEN
410          TYPE *, ' NO IDENTIFICATIONS.'
411          GO TO 1858
412          ENDIF
413          DELTAII=DELTAI/FLOAT(IICOUNT)
414          IF(IICOUNT.EQ.1)THEN
415          WRITE(6,914)DELTAI
416          914      FORMAT(1X,'IDENTIFICATION TIME FOR SINGLE ID=',F7.3)
417          GO TO 1858
418          ENDIF
419          SD=SQRT((DELTAIS-(FLOAT(IICOUNT)*DELTAII**2))/(FLOAT(IICOUNT)-1.#))
420          WRITE(6,557)DELTAII,IICOUNT,SD
421          557      FORMAT(1X,'MEAN IDENTIFICATION TIME=',F18.3,1X,'SECONDS',1X,
422          1'ON',17,' TARGETS',/,1X,'WITH A STANDARD DEVIATION OF',
423          2F18.3)
424          1858      CONTINUE
425          CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
426          C
427          C      1. OBJECT DESIGNATION TIMES
428          C      2. TARGET DETECTION AND DESIGNATION TIMES
429          C      3. TARGET RECOGNITION TIMES
430          C      4. TARGET IDENTIFICATION TIMES
431          C
432          C      1,2,3 AND 4 ARE ALL CORRELATED WITH MINI RANGER IRIGS TO CALCULATE
433          C      RANGES. GROUND TRUTH TELLS US WHICH TARGET TO CALCULATE THE RANGE
434          C      TOO. THE VARIABLE ITANKI CONTAINS THE ACTUAL TARGET NUMBER THAT
435          C      WAS DETECTED.
436          C
437          CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
438          DO 3333 IPLOT=1,3
439          DO INITIALTS=1,4
440          ALTS(INITALTS)=#

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441          ENDDO
442          INCOUNT=0
443          CCCCCCCCCCCCCCCCCCCCCCCCCC
444          IF(IPLT.EQ.1)IEND=INDELTA
445          IF(IPLT.EQ.2)IEND=INDELTA
446          IF(IPLT.EQ.3)IEND=INDELTA
447          C          IEND=INDELTA
448          CCCCCCCCCCCCCCCCCCCCCCCCCC
449          DO 5 I=1,IEND
450          CCCCCCCCCCCCCCCCCCCCCCCCCC
451          IF(IPLT.EQ.1)THEN
452          STIME=HDELTA(I)
453          ITANKI=ITANKID(I)
454          C          TYPE*, 'DETECTION PLOT ITANKI=', ITANKI
455          ENDIF
456          IF(IPLT.EQ.2)THEN
457          STIME=HDELTA(I)
458          ITANKI=ITANKIR(I)
459          C          TYPE*, 'RECOG PLOT ITANKI=', ITANKI
460          ENDIF
461          IF(IPLT.EQ.3)THEN
462          STIME=HDELTA(I)
463          ITANKI=ITANKII(I)
464          C          TYPE*, 'ID PLOT ITANKI=', ITANKI
465          ENDIF
466          C          STIME=HDELTA(I)
467          CCCCCCCCCCCCCCCCCCCCCCCCCC
468          DO 5 J=1,IL
469          TIMJ=TIM(J)
470          TIMJ=TIM(J)
471          TIMEMINI=FLOAT(TIDAY(J)-215)*60.*60.*60.+
472          ITINJ*60.*60.+TIMJ*60.+TSEC(J)
473          IF(TIMEMINI.LT.STIME)GO TO 5
474          IF(TIMEMINI.GT.STIME+8.)GO TO 7722
475          C          TYPE*, ' TIMEMINI=', TIMEMINI, ' STIME=', STIME, ' DIFF=',
476          C          IABS(STIME-TIMEMINI)
477          IF(J.GT.1)THEN
478          ITINN=TIM(J-1)
479          ITIMM=TIM(J-1)
480          ITDAY2=TIDAY(J-1)
481          SMTIME=TCVT(ITDAY2, ITINN, ITIMM, TSEC(J-1))
482          C          TYPE *, 'SMTIME-STIME TESTING', SMTIME-STIME, 'SMTIME=',
483          C          SMTIME, 'STIME=', STIME
484          IF(ABS(SMTIME-STIME).LT.ABS(TIMEMINI-STIME))THEN
485          IF(ABS(SMTIME-STIME).GT.ERRORMINI)GO TO 7722
486          JJ=J-1
487          GO TO 7
488          ENDIF
489          ENDIF
490          C          ITINN=TIM(J+1)
491          C          ITIMM=TIM(J+1)
492          C          ITDAY2=TIDAY(J+1)
493          C          SMTIME=TCVT(ITDAY2, ITINN, ITIMM, TSEC(J+1))
494          C          TYPE *, ' TIMEMINI-STIME TESTING', TIMEMINI-STIME
495          C          IF(ABS(TIMEMINI-STIME).GE.ABS(STIME-SMTIME))GO TO 5

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496 IF(ABS(TIMEMINI-STIME).GT.ERRORMINI)GO TO 5
497 C ERRORMINI IS USED AS A MAX ERROR ALLOWED FOR USABLE MINI RANGER INFORMATION
498 JJ=J
499 7 TIMJ=TIM(JJ)
500 TIMJ=TIM(JJ)
501 TIMEMINI=FLOAT(TIDAY(JJ)-215)*60.*60.*60.+
502 ITIMJ*60.*60.+TIMJ*60.+TSEC(JJ)
503 TERROR=ABS(TIMEMINI-STIME)
504 IF(TERROR.GE.ERRORMINI)GO TO 7722
505 C TYPE='JJ='JJ,'TX(JJ)='TX(JJ),'VALID='VALID,'ITANKI='ITANKI,
506 1'IRIG='TIN(JJ),TIM(JJ),TSEC(JJ)
507 C TYPE='VTANK='VTANK(ITANKI),'IL='IL,
508 1'DELX='DELX,'DELY='DELY,'XTANK='XTANK(ITANKI)
509
510 DELX=XTANK(ITANKI)+TX(JJ)
511 DELY=VTANK(ITANKI)+TY(JJ)
512 DELZ=625.*3048 (DEFAULT ALTITUDE FOR FALSE TARGET RUNS ETC.
513
514 C TYPE *, 'I='I, 'STIME='STIME,'TIMEMINI='TIMEMINI,'SSTIME='
515 C 1SSTIME,'SMTIME='SMTIME,'TX(JJ)='TX(JJ),'TY(JJ)='TY(JJ),
516 C 2'JJ='JJ,'ITANKI='ITANKI,'DELX='DELX,'DELY='DELY
517 IDA=1
518 C SEQ1
519 IF(STIME.GE.TCVT(215,18,55,12.)
520 1.AND.STIME.LE.TCVT(215,18,56,12.130))THEN
521 DELZ=.3048*625.
522 431 ALTS(3)=ALTS(3)+1
523 IDA=#
524 GO TO 1999
525 ENDIF
526 C SEQ2
527 IF(STIME.GE.TCVT(216,15,25,34.)
528 1.AND.STIME.LE.TCVT(216,15,26,44.860))THEN
529 DELZ=.3048*330.
530 C GO TO 6 |***** FOR SELECTIVE ALTITUDE PLOTS
531 IDA=#
532 430 ALTS(1)=ALTS(1)+1
533 GO TO 1999
534 ENDIF
535 C SEQ3
536 IF(STIME.GE.TCVT(216,15,40,50.)
537 1.AND.STIME.LE.TCVT(216,15,41,30.985))THEN
538 DELZ=.3048*500.
539 C GO TO 6 |***** FOR SELECTIVE ALTITUDE PLOTS
540 IDA=#
541 432 ALTS(2)=ALTS(2)+1
542 GO TO 1999
543 ENDIF
544 C
545 C NOTE THAT NOTHING IS HERE FOR SEQ 4 SINCE THEY SHOULD ALL BE INVALID
546 C
547 C SEQ5
548 IF(STIME.GE.TCVT(215,19,7,6.)
549 1.AND.STIME.LE.TCVT(215,19,8,22.210))THEN
550 DELZ=.3048*500.

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851      C      GO TO 6      |***** FOR SELECTIVE ALTITUDE PLOTS
852      433      IDA=#
853      ALTS(2)=ALTS(2)+1
854      GO TO 1999
855      ENDIF
856
857      C SEQ6
858      IF(STIME.GE.TCVT(216,16,1,36.)
859      1.AND.STIME.LE.TCVT(216,16,2,27.432))THEN
860      DELZ=.3848*825.
861      434      IDA=#
862      ALTS(3)=ALTS(3)+1
863      GO TO 1999
864      ENDIF
865
866      C SEQ7
867      IF(STIME.GE.TCVT(216,16,6,67.)
868      1.AND.STIME.LE.TCVT(216,16,18,2.817))THEN
869      DELZ=.3848*336.
870      C
871      429      GO TO 6 |***** FOR SELECTION OF SPECIFIC ALTITUDES FOR PLOTTING
872      IDA=#
873      ALTS(1)=ALTS(1)+1
874      GO TO 1999
875      ENDIF
876
877      C SEQ8
878      IF(STIME.GE.TCVT(216,19,31,13.)
879      1.AND.STIME.LE.TCVT(216,19,32,36.))THEN
880      DELZ=326.-.3848
881      C
882      428      GO TO 6 |***** FOR SELECTION OF SPECIFIC ALTITUDES FOR PLOTTING
883      IDA=#
884      ALTS(1)=ALTS(1)+1
885      GO TO 1999
886      ENDIF
887
888      C SEQ9
889      IF(STIME.GE.TCVT(216,16,66,62.)
890      1.AND.STIME.LE.TCVT(216,16,61,62.322))THEN
891      DELZ=.3848*666.
892      C
893      435      GO TO 6 |***** FOR SELECTIVE ALTITUDE PLOTS
894      IDA=#
895      ALTS(2)=ALTS(2)+1
896      GO TO 1999
897      ENDIF
898
899      C SEQ10
900      IF(STIME.GE.TCVT(216,16,68,8.)
901      1.AND.STIME.LE.TCVT(216,16,69,2.229))THEN
902      DELZ=.3848*825.
903      436      IDA=#
904      ALTS(3)=ALTS(3)+1
905      GO TO 1999
906      ENDIF
907
908      C SEQ11
909      IF(STIME.GE.TCVT(216,18,61,4.)
910      1.AND.STIME.LE.TCVT(216,18,62,18.608))THEN
911      DELZ=.3848*825.
912      437      IDA=#
913      ALTS(3)=ALTS(3)+1
914      GO TO 1999
915

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606      ENDIF
607      C SEQ12
608      IF(STIME.GE.TCVT(216,16,44,16.))
609      1.AND.STIME.LT.TCVT(216,16,45,6.))THEN
610      DELZ=.3048*600.
611      C
612      GO TO 6 )***** FOR SELECTIVE ALTITUDE PLOTS
613      438
614      IDA=#
615      ALTS(2)=ALTS(2)+1
616      GO TO 1999
617      ENDIF
618      C
619      C
620      NOTE THAT NOTHING IS HERE FOR SEQ 13 SINCE ALL SHOULD BE INVALID
621      C
622      C SEQ14
623      IF(STIME.GE.TCVT(216,19,23,17.))
624      1.AND.STIME.LE.TCVT(216,19,24,25.692))THEN
625      DELZ=.3048*325.
626      C
627      GO TO 6 )***** FOR SELECTION OF SPECIFIC ALTITUDES FOR PLOTTING
628      427
629      IDA=#
630      ALTS(1)=ALTS(1)+1
631      GO TO 1999
632      ENDIF
633      C SEQ15
634      IF(STIME.GE.TCVT(216,16,05,4.))
635      1.AND.STIME.LE.TCVT(216,16,6,59.926))THEN
636      DELZ=.3048*030.
637      439
638      IDA=#
639      ALTS(3)=ALTS(3)+1
640      GO TO 1999
641      ENDIF
642      C
643      SEQ16 IS THE SAME AS 8 SO WE DON'T WANT TO COUNT THEM TWICE
644      C
645      IF(TIMEMINI.GE.TCVT(216,19,31,13.))
646      1.AND.TIMEMINI.LE.TCVT(216,19,32,30.))THEN
647      DELZ=.3048*325.
648      C
649      IDA=#
650      ALTS(1)=ALTS(1)+1
651      C
652      ENDIF
653      C
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1000      C

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716      C      DO IPRINT=1,INCOUNTI
717      C      TYPE *,NDELTAI(IPRINT),IPRINT,INCOUNTI
718      C      ENDDO
719      CALL HIST2(4,NDELTAI,INCOUNTI)  I FOR IDENTIFICATION DELTA HISTOGRAM
720      STOP ' ALL DONE'
721      7676  CONTINUE
722      C      TYPE *, ' TAPE NUM LINE READ'
723      NOPER=NOPER+1
724      ITANKI=0
725      VALID=0
726      GO TO 1
727      END
728      FUNCTION TCVT(IDAY,IN,IM,SEC)
729      TCVT=FLOAT(IDAY-215)*60.*60.*60.+FLOAT(IN)*60.*60.+
730      IFLOAT(IM)*60.+SEC
731      RETURN
732      END
733      SUBROUTINE GTRUTH(IDAY,IN,IM,SEC,X,Y,VALID,ITARGETN)
734      PARAMETER MEM=30000
735      BYTE IN,IM,VALID,TIN(MEM),TIM(MEM),SEQN,TARGETS(10,10)
736      BYTE NUMT(10)
737      DIMENSION TSEC(MEM),ERRORP(10)
738      INTEGER*2 TIDAY(MEM),BOX(4,MEM),IDAY,BOXES(4),BOXN,T(13),SEQS(19)
739      INTEGER TDAY,TIMH,TIMM,ITARGETN,TDAY2,TIMH2,TIMM2,BEGINS,ENDS
740      DATA GERROR/10./
741      C      MAX ALLOWABLE SKIP IN GROUND TRUTH
742      C      NUMT(X) CONTAINS THE NUMBER OF TARGETS TRACKED DURING THE X RUN SEQ
743      DATA NUMT/6,7,4,8,4,9,6,3,8,9,8,4,8,4,4,3,8,2/
744      C      TARGETS IS A BYTE ARRAY THAT CONVERTS T NUMBERS TO ACTUAL TARGET NUMBERS
745      C      THE FIRST INDEX IS THE T NUMBER 1 TO 10
746      C      THE SECOND INDEX IS THE SEQUENCE NUMBER 1 TO 10 ON TAPE 1
747      C      SEQS(19) IS THE COUNT FOR ALL OUT OF IRIG GROUND TRUTH DESIGNATIONS
748      COMMON/COUNTS/IFSEQ4,IFSEQ13,IFSEQ17,SEQS
749      DATA SEQS/19*0/
750      DATA INIT/1/,IFSEQ4/0/,IFSEQ13/0/,IFSEQ17/0/
751      DATA ((TARGETS(N,M),M=1,10),M=1,10)/4,2,1,9,8,7,4*1,
752      29,8,6,7,4,10,1,3*1,
753      37,8,9,10,6*1,
754      410*1,
755      51,2,4,3,6*1,
756      69,8,7,6,5,4,3,13,10,1,
757      73,9,8,6,7,6,4*1,
758      81,2,4,7*1,
759      910,1,4,5,6,7,8,9,2*1,
760      113,1,12,4,5,6,7,8,9,1,
761      19,8,7,6,4,3,2,1,2*1,
762      27,8,9,10,6*1,
763      310*1,
764      41,2,3,4,6*1,
765      510,12,13,1,6*1,
766      61,2,4,7*1,
767      710*1,
768      813,1,8*1/
769      IF(INIT)THEN
770      TYPE *, ' READING GROUND TRUTH DATA FILE GROUND.FFF.. STANDBY.'

```

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771 OPEN(UNIT=9,NAME='GROUND.FFF',TYPE='OLD',READONLY,SHARED)
772 IC=0
773 READ(9,221,END=100)IDAY,IM,IM,SEC,(BOXES(1),I=1,4)
774 221 FORMAT(1X,Z4,1X,I2,1X,I2,1X,F7.3,4(3X,I4))
775 IC=IC+1
776 BOX(1,IC)=BOXES(1) ILEFT
777 BOX(2,IC)=BOXES(2) IRIGHT
778 BOX(3,IC)=BOXES(3) ITOP
779 BOX(4,IC)=BOXES(4) IBOTTOM
780 TIN(IC)=IM
781 TIM(IC)=IM
782 TSEC(IC)=SEC
783 TIDAY(IC)=IDAY
784 C WRITE(6,67)IM,IM,SEC
785 67 FORMAT(1X,I2,' ',I2,' ',F6.2)
786 GO TO 2
787 100 TYPE = 'TOTAL NUMBER OF IRIGS=',IC
788 INIT=0
789 RETURN
790 ENDDIF
791 C.....
792 C ENTER HERE AFTER INITIAL GROUND TRUTH FILE READ
793 C.....
794 VALID=0
795 INR=IM
796 INR=IM
797 IDDAY=IDAY
798 TIME=TCVT(IDDAY,INR,INR,SEC)
799 C PRINT 16,IDAY,IM,IM,SEC,TIME
800 16 FORMAT(1X,' TIME=',I3,' ',I2,' ',I2,' ',F6.2,5X,F20.5)
801 C SEQ 1
802 IF(TIME.GE.TCVT(216,18,55,21.000).AND.
803 1 TIME.LE.TCVT(216,18,56,12.130))THEN
804 C RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
805 800 BEGINS=2009
806 ENDS=3233
807 SEQN=1
808 SEQ(1)=SEQS(1)+1
809 GO TO 1
810 ENDDIF
811 C SEQ 2
812 IF(TIME.GE.TCVT(216,15,25,59.455).AND.
813 1 TIME.LE.TCVT(216,15,26,44.050))THEN
814 C RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
815 809 BEGINS=6070
816 ENDS=7167
817 SEQN=2
818 SEQ(2)=SEQS(2)+1
819 GO TO 1
820 ENDDIF
821 C SEQ3
822 IF(TIME.GE.TCVT(216,15,41, 6.102).AND.
823 1 TIME.LE.TCVT(216,15,41,30.905))THEN
824 C RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
825 807 SEQN=3

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026          BEGINS=7168
027          ENDS=7682
028          SEQS(3)=SEQS(3)+1
029          GO TO 1
030          ENDIF
031      C      SEQ4      FALSE TARGET RUN
032          IF(TIME.GE.TCVT(216,15,34,12.888).AND.
033             1 TIME.LE.TCVT(216,15,38,22.888))THEN
034          IFSEQ4=IFSEQ4+1
035      C      TYPE *, ' FALSE TARGET IN RUN SEQ 17',IFSEQ4
036          RETURN
037          ENDIF
038      C      SEQ5
039          IF(TIME.GE.TCVT(215,19, 7.45,232).AND.
040             1 TIME.LE.TCVT(215,19, 8,22,218))THEN
041      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
042      886      SEQN=5
043          BEGINS=3234
044          SEQS(5)=SEQS(5)+1
045          ENDS=4141
046          GO TO 1
047          ENDIF
048      C      SEQ6
049          IF(TIME.GE.TCVT(216,16, 1,38,918).AND.
050             1 TIME.LE.TCVT(216,16, 2,27,432))THEN
051      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
052      793      SEQN=6
053          BEGINS=18153
054          ENDS=11575
055          SEQS(6)=SEQS(6)+1
056          GO TO 1
057          ENDIF
058      C      SEQ7
059          IF(TIME.GE.TCVT(215,15, 9, 1.826).AND.
060             1 TIME.LE.TCVT(215,15,18, 2.817))THEN
061      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
062      885      SEQN=7
063          BEGINS=1
064          ENDS=756
065          SEQS(7)=SEQS(7)+1
066          GO TO 1
067          ENDIF
068      C      SEQ8
069          IF(TIME.GE.TCVT(215,19,32, 2.424).AND.
070             1 TIME.LE.TCVT(215,19,32,29.381))THEN
071      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
072      884      SEQN=8
073          BEGINS=4883
074          ENDS=6598
075          SEQS(8)=SEQS(8)+1
076          GO TO 1
077          ENDIF
078      C      SEQ9
079          IF(TIME.GE.TCVT(216,15,51, 9.556).AND.
080             1 TIME.LE.TCVT(216,15,51,52.322))THEN

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881      SEQN=9
882      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
883      883      BEGINS=8191
884      ENDS=9124
885      SEQ(9)=SEQ(9)+1
886      GO TO 1
887      ENDIF
888      C      SEQ 10
889      IF(TIME.GE.TCVT(216,16,60,5.345).AND.
890      1 TIME.LE.TCVT(216,16,60,2.229))THEN
891      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
892      882      SEQN=10
893      BEGINS=9125
894      ENDS=10152
895      SEQ(10)=SEQ(10)+1
896      GO TO 1
897      ENDIF
898      C      SEQ 11
899      IF(TIME.GE.TCVT(216,16,61,17.258).AND.
900      1 TIME.LE.TCVT(216,16,62,18.588))THEN
901      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
902      881      SEQN=11
903      BEGINS=757
904      ENDS=2888
905      SEQ(11)=SEQ(11)+1
906      GO TO 1
907      ENDIF
908      C      SEQ12
909      IF(TIME.GE.TCVT(216,16,44,28.438).AND.
910      1 TIME.LE.TCVT(216,16,44,57.563))THEN
911      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
912      888      SEQN=12
913      BEGINS=7683
914      ENDS=8198
915      SEQ(12)=SEQ(12)+1
916      GO TO 1
917      ENDIF
918      C      SEQ 13 FALSE TARGET RUN
919      IF(TIME.GE.TCVT(216,16,49,38.888).AND.
920      1 TIME.LE.TCVT(216,16,50,19.888))THEN
921      IFSEQ13=IFSEQ13+1
922      C      TYPE ", " FALSE TARGET IN RUN SEQ 13',IFSEQ13
923      RETURN
924      ENDIF
925      C      SEQ 14
926      IF(TIME.GE.TCVT(216,19,23,57.769).AND.
927      1 TIME.LE.TCVT(216,19,24,25.692))THEN
928      C      RETURN 1 *****SELECTIVE SEQUENCE PROCESSING
929      799      SEQN=14
930      BEGINS=4142
931      ENDS=4882
932      SEQ(14)=SEQ(14)+1
933      GO TO 1
934      ENDIF
935      C      SEQ 15

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991      ENDF
992      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
993      C
994      C      HE TOUCHED SOMETHING ON THE SCREEN.. NOT THE MENU.
995      C
996      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
997      I TARGETN=0      I RESET THE TARGET NUMBER FOR NEXT MENU INPUT CHECK
998      C      TYPE *, ' OPERATOR INPUT.....',X,Y
999      DO 5 I=1,IC
1000      TDAY=IAND(TIDAY(I),'#FF'X)
1001      TIHH=TIH(I)
1002      TIMM=TIM(I)
1003      GTIME=TCVT(TDAY,TIHH,TIMM,TSEC(I))
1004      C      PRINT 156,TDAY,TIHH,TIMM,TSEC(I),GTIME,I
1005      156      FORMAT(1X,'GTIME=',I3,'.',I2,'.',I2,'.',F6.2,5X,F2#.5,5X,16)
1006      IF(GTIME.LT.TIME)GO TO 5
1007      TDAY2=IAND(TIDAY(I+1),'#FF'X)
1008      TIHH2=TIH(I+1)
1009      TIMM2=TIM(I+1)
1010      GGTIME=TCVT(TDAY2,TIHH2,TIMM2,TSEC(I+1))
1011      IF(GTIME.EQ.GGTIME)GO TO 5
1012      IF(ABS(GTIME-TIME).GT.GERROR)GO TO 5
1013      C      TYPE *, ' TIME=',TIME,' GTIME=',GTIME,' GGTIME=',GGTIME
1014      C      TYPE *, ' I=',I,' TIME=',TIME,' GTIME=',GTIME
1015      I1=I
1016      IF(I1.GT.BEGINS)I1=I-1
1017      I2=BEGINS
1018      I3=-1
1019      I4=0
1020      101      IF(I1.LT.BEGINS.OR.I1.GT.ENDS)THEN
1021      TYPE *, ' GROUND TRUTH INDEX INVALID'
1022      TYPE *, ' BEGINS=',BEGINS,' ENDS=',ENDS,' I=',I,' SEQN=',SEQN
1023      RETURN
1024      ENDF
1025      C      IF(I4.EQ.0)TYPE *, ' SEARCH DOWN IRIG'
1026      C      IF(I4.EQ.1)TYPE *, ' SEARCH UP IRIG'
1027      DO 111 IA=I1,I2,I3
1028      IZBOX=0
1029      DO 999 JJJ=1,4
1030      IF(BOX(JJJ,IA).NE.0)GO TO 999
1031      IZBOX=IZBOX+1
1032      999      CONTINUE
1033      IF(IZBOX.EQ.4)GO TO 111
1034      BOXN=ISHFT(TIDAY(IA),-12)
1035      C      TYPE *, ' BOXN=',BOXN
1036      IF(T(BOXN).NE.0)GO TO 111
1037      T(BOXN)=IA
1038      DO 112 ITN=1,NUMT(SEQN)
1039      C      TYPE *, ' T(ITN)=',T(ITN),' SEQN=',SEQN,' BOXN=',BOXN,
1040      C      I' IA=',IA,' NO. TARGETS=',NUMT(SEQN),' ITN=',ITN
1041      IF(T(ITN).NE.0)THEN
1042      GO TO 112
1043      ENDF
1044      GO TO 111
1045      112      CONTINUE

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1846      GO TO 212
1847      CONTINUE
1848      GO TO 214
1849      IF WE GET HERE ALL TARGET BOXES HAVE BEEN LOCATED
1850      FOR THIS OPERATOR IRIG SO LET'S COMPARE X,Y
1851      C      TYPE *, 'OPERATOR INPUT=',X,Y
1852      C212    DO JJJ=1,NUNT(SEQN)
1853      C      L9=T(JJJ)
1854      C      TYPE *, ' ',TIDAY(L9), ' ',TIN(L9), ' ',TIN(L9), ' ',TSEC(L9),
1855      C      1' ',BOX(1,L9),BOX(2,L9),BOX(3,L9),BOX(4,L9),
1856      C      2' TARGET #-',TARGETS(JJJ,SEQN)
1857      C      ENDDO
1858      C      ACCEPT *,JJJ
1859      212    CONTINUE
1860      DO 213 ITN=1,NUNT(SEQN)
1861      ERRORP(ITN)=99999.
1862      ERRORX=.5*FLOAT(BOX(1,T(ITN))-BOX(2,T(ITN)))
1863      ERRORY=.5*FLOAT(BOX(3,T(ITN))-BOX(4,T(ITN)))
1864      IF(ERRORX.LT.15.)ERRORX=15.
1865      IF(ERRORY.LT.15.)ERRORY=15.
1866      C      PRINT 1214,X,Y,(BOX(K,T(ITN)),K=1,4)
1867      1214    FORMAT(1X,'X=',F6.2,' Y=',F6.2,' BOX=',4(1X,I4))
1868      XLEFT=FLOAT(BOX(1,T(ITN)))-ERRORX
1869      XRIGHT=FLOAT(BOX(2,T(ITN)))+ERRORX
1870      IF(X.LT.XLEFT.OR.
1871      1 X.GT.XRIGHT)GO TO 213
1872      YTOP=FLOAT(BOX(3,T(ITN)))-ERRORY
1873      YBOTTOM=FLOAT(BOX(4,T(ITN)))+ERRORY
1874      IF(Y.LT.YTOP.OR.
1875      1 Y.GT.YBOTTOM)GO TO 213
1876      CX=(XLEFT+XRIGHT)/2.
1877      CY=(YTOP+YBOTTOM)/2.
1878      XERR=ABS(X-CX)
1879      YERR=ABS(Y-CY)
1880      ERRORP(ITN)=SQRT(XERR**2+YERR**2)
1881      C      TYPE *, ' WE HAVE A GOOD ONE HERE!!!!'
1882      C      WE HAVE A GOOD ONE HERE!!!!
1883      213    CONTINUE
1884      XMAX=99999.
1885      ITARG=#
1886      DO ITN=1,NUNT(SEQN)
1887      C      TYPE *, ' ITN=',ITN,' ERRORP(ITN)=',ERRORP(ITN)
1888      IF(ERRORP(ITN).LT.XMAX)THEN
1889      ITARG=ITN
1890      XMAX=ERRORP(ITN)
1891      ENDIF
1892      ENDDO
1893      IF(ITARG.EQ.#)THEN
1894      C      TYPE *, ' OPERATOR DIDN'T HIT ANYWHERE NEAR A TARGET!!'
1895      C      TYPE *, 'X=',X,' Y=',Y
1896      RETURN ' OPERATOR DIDN'T HIT ANYWHERE NEAR A TARGET!!'
1897      ENDIF
1898      222    VALID=1
1899      ITARGETN=TARGETS(ITARG,SEQN)
1900      C      TYPE *, 'X=',X,' Y=',Y,' GROUND TRUTH TARGET NUMBER=',ITARGETN

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1101      RETURN
1102      IF(I4.EQ.0)THEN
1103          I1=I
1104          I2=ENDS
1105          I3=1
1106          I4=1
1107          GO TO 101
1108      ENDIF
1109      TYPE *, ' * CAN'T FIND ALL TARGETS IN GROUND TRUTH SEARCH'
1110      DO 215 IA=1,NUNT(SEGN)
1111          PRINT 216,IA,T(IA)
1112          FORMAT(IX,'IA=',I2,' T(IA)=' ,I6)
1113      215 CONTINUE
1114      TYPE *, 'WE REALLY HAVE PROBLEMS IF THIS IS PRINTED'
1115      RETURN      IVE REALLY HAVE PROBLEMS IF WE RETURN FROM HERE...
1116      C44      TYPE *, ' TIME>GTIME=',TIME,GTIME
1117      5 CONTINUE
1118      7722      ITDAY=IAND(IDAY,'00FF'X)
1119      PRINT 6,ITDAY,IN,IN,SEC
1120      6      FORMAT(IX,'***** NO GROUND TRUTH FOR ',I3,' ',I2,' ',I2,' ',F6.2)
1121      RETURN
1122      END
1123      SUBROUTINE CVTT(STIME,IDAYC,INC,INC,SEC)
1124      IF(STIME.GT.60.*60.*60.)THEN
1125          IDAYC=216
1126          TIME=STIME-(60.*60.*60.)
1127          INC=INT(TIME/(60.*60.))
1128          TIME=TIME-(FLOAT(INC)*60.*60.)
1129          INC=INT(TIME/60.)
1130          SEC=TIME-(FLOAT(INC)*60.)
1131      RETURN
1132      ENDIF
1133      IDAYC=216
1134      INC=INT(STIME/(60.*60.))
1135      TIME=STIME-(FLOAT(INC)*60.*60.)
1136      INC=INT(TIME/60.)
1137      SEC=TIME-(FLOAT(INC)*60.)
1138      RETURN
1139      END

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APPENDIX C

GROUND TRUTH DATA COLLECTION PROGRAM

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C-----
C
C      IRIG(1)=FIRST IRIG TIME WORD
C      IRIG(2)=SECOND IRIG TIME WORD
C      IRIG(3)=THIRD IRIG TIME WORD
C      IRIG(4)=GATE SIZES OF THE TRACK GATE (TOP AND BOTTOM)
C      IRIG(5)=GATE SIZES OF THE TRACK GATE (LEFT AND RIGHT)
C      IRIG(6)=16 BITS THAT CONTAIN THE X AND Y POSITION OF THE CURSOR
C
C      BOXES(4#) IS THE ARRAY THAT CONTAINS THE 1# BOX POSITIONS
C      LEFT,RIGHT,UP AND DOWN<-- IN THAT ORDER
C-----
C
C      EXTERNAL IOS_READVBLK,IOS_WRITEVBLK,QXRAS
C      DOUBLE PRECISION QUAD
C      INTEGER SYS$WAITFR,SYS$SBINTIM,TTCHAN
C      BYTE C
C      INTEGER*2 IRIG(6),IV(2),ND,TD,UD,TH,UH,TM,UM,TS1,TS2,US,LS,MS
C      INTEGER*2 OBOX5,OBOX6,OBOX7,OBOX8,OBOX5M1,OBOX5P1,OBOX7M1
C      INTEGER*2 OBOX7P1,IF1,TFLAG
C      INTEGER*2 OBOX6M1,OBOX6P1,OBOX8M1,OBOX8P1,OPASS
C      PARAMETER MEM1=1#
C      PARAMETER NOISE=2
C      BYTE IM,IN
C      INTEGER*2 IDAY
C      INTEGER*2 TINDEX,OIH
C
C      TINDEX IS THE ARRAY INDEX FOR THE TARGET INFORMATION
C      BYTE TAPECNTRL
C      INTEGER*2 IOSB(4),BOXES(4#),BLINKM,ISAVE(2)
C      INTEGER SYS$QIOW,SYS$ASSIGN,SYS$QIO,SYS$LKVSET
C      INTEGER INLOCK(2),IOLOCK(2)
C      PARAMETER TEN=1#
C      CHARACTER*16 TIME,TIMED(TEN)
C      INTEGER*2 TTH(TEN),TUH(TEN),TTM(TEN),TUM(TEN),TTS1(TEN)
C      INTEGER*2 TUS(TEN)
C      INTEGER*2 PASS
C      BYTE X,Y,XV(2),TOP,BOTTOM,LEFT,RIGHT,TB(2),LR(2)
C      EQUIVALENCE(XV(1),X),(XV(2),Y),(IRIG(6),XV(1))
C      EQUIVALENCE(TB(1),BOTTOM),(TB(2),TOP),(IRIG(5),TB(1))
C      EQUIVALENCE(LR(1),LEFT),(LR(2),RIGHT),(IRIG(4),LR(1))
C      EQUIVALENCE(IRIG2,IRIG(2))
C      COMMON/CHAN/TTCHAN
C      DATA N/1/
C      DATA IF1/0/
C      DATA TINDEX/0/,TFLAG/0/
C      DATA TTH/1#*1/
C      DATA TUH/1#*3/
C      DATA TTH/0,0,0,0,0,1,0,0,0,0/
C      DATA TUH/0,1,3,5,9,0,0,0,0,0/
C      DATA TTS1/0,0,3,3,0,3,0,0,0,0/
C      DATA TUS/0,0,0,0,0,0,0,0,0,0/
C      DATA TIMED/
C      1'0000 00:00:17.00',
C      2'0000 00:00:07.50',
C      3'0000 00:00:05.00',

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56      3'0000 00:00:06.50',
57      4'0000 00:00:16.00',
58      5'0000 00:00:03.75',
59      64'0000 00:00:00.00'/
60      PARAMETER STOP=1
61      PARAMETER FF=2
62      PARAMETER FORWARD=4
63      PARAMETER REWIND=8
64      ISTATUS=SYSSASSIGN('XRAS',GRCHAN,,)
65      IF(.NOT.ISTATUS)TYPE *, ' ERROR IN GRA1 CHANNEL ASSIGN'
66      ISTATUS=SYSSASSIGN('TTBS',TTCHAN,,)
67      IF(.NOT.ISTATUS)
68      ITYPE *, ' ERROR IN TTBS ACOUSTIC TOUCH SCREEN CHANNEL ASSIGN'
69      CALL QASTTBS
70      TYPE *, ' ENTER CONTROL Y WHEN ALL DONE WITH THIS TAPE PASS'
71      PASS=1
72      IF(PASS.EQ.1)THEN
73      OPEN(UNIT=9,NAME='TARGETS1.DAT',TYPE='NEW',FORM='UNFORMATTED')
74      ENDIF
75      C TAPECTRL=STOP
76      C CALL TAPEREMOT(TAPECTRL)
77      C TAPECTRL=FORWARD
78      C CALL TAPEREMOT(TAPECTRL)
79      INLOCK(1)=XLOC(BOXES(1))
80      INLOCK(2)=XLOC(BOXES(48))
81      K=SYSLKVSET(INLOCK,IOLOCK,)
82      TYPE *, ' INLOCK(1)= ',INLOCK(1), ' INLOCK(2)= ',INLOCK(2)
83      TYPE *, ' IOLOCK(1)= ',IOLOCK(1), ' IOLOCK(2)= ',IOLOCK(2)
84      IF(.NOT.K)TYPE *, ' UNABLE TO LOCK BOXES I/O BUFFER'
85      INLOCK(1)=XLOC(IRIG(1))
86      INLOCK(2)=XLOC(IRIG(6))
87      K=SYSLKVSET(INLOCK,IOLOCK,)
88      TYPE *, ' INLOCK(1)= ',INLOCK(1), ' INLOCK(2)= ',INLOCK(2)
89      TYPE *, ' IOLOCK(1)= ',IOLOCK(1), ' IOLOCK(2)= ',IOLOCK(2)
90      IF(.NOT.K)TYPE *, ' UNABLE TO LOCK IRIG I/O BUFFER'
91      I K=SYSSOIOW(XVAL(1),XVAL(GRCHAN),XVAL(XLOC(IOS_READVBLK)),IOSB,
92      C IOXRAS,C,IRIG(1),XVAL(12),...)
93      I,IRIG(1),XVAL(12),...)
94      IF(IRIG(3))GO TO 1
95      C WRITE(6,567)X,Y,IRIG(1),IRIG(2),IRIG(3)
96      567 FORMAT(1X,'X=',03,8X,'Y=',03,1X,06,1X,06,1X,06)
97      HD=ISHFT(IRIG(1),-12)
98      TD=IAND(ISHFT(IRIG(1),-8),'F'X)
99      UD=IAND(ISHFT(IRIG(1),-4),'F'X)
100     T=IAND(IRIG(1),'3'X)
101     UM=ISHFT(IRIG(2),-12)
102     TM=IAND(ISHFT(IRIG(2),-9),'7'0)
103     UM=IAND(ISHFT(IRIG(2),-8),'F'X)
104     TS1=IAND(ISHFT(IRIG(2),-2),'7'0)
105     ISAVE(1)=IAND(ISHFT(IRIG(2),2),'C'X)
106     ISAVE(2)=ISHFT(IRIG(3),-14)
107     US=IOR(ISAVE(1),ISAVE(2))
108     TS2=IAND(ISHFT(IRIG(3),-10),'F'X)
109     LS=IAND(ISHFT(IRIG(3),-6),'F'X)
110     MS=IAND(ISHFT(IRIG(3),-2),'F'X)

```

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111      IRIG2=ISHFT(IRIG2,-2)
112      C      WRITE(6,666)HD,TD,UD,TN,UM,TM,UM,TS1,US,TS2,LS,MS
113      666      FORMAT(1X,'DAY OF THE YEAR=',3I1,1X,'TIME=',2I1,1I,'',
114      12Z1,'',2Z1,'',3Z1)
115      BOXES(1)=#
116      BOXES(2)=#
117      BOXES(3)=#
118      BOXES(4)=#
119      BOXES(5)=TOP
120      C      BOXES(33)=TOP
121      C      BOXES(5)=X
122      IF (BOXES(5).LT.#)BOXES(5)=IAND(BOXES(5),'377'0)
123      IF (BOXES(5).LT.1)BOXES(5)=1
124      IF (BOXES(5).GT.254)BOXES(5)=254
125      C      BOXES(5)=BOXES(5).OR.'#14#'0
126      BOXES(6)=BOTTOM
127      C      BOXES(34)=BOTTOM
128      C      BOXES(6)=BOXES(5)+1#
129      IF (BOXES(6).LT.#)BOXES(6)=IAND(BOXES(6),'377'0)
130      IF (BOXES(6).GT.254)BOXES(6)=254
131      BOXES(7)=LEFT
132      C      BOXES(35)=LEFT
133      C      BOXES(7)=Y
134      IF (BOXES(7).LT.#)BOXES(7)=IAND(BOXES(7),'377'0)
135      IF (BOXES(7).LT.1)BOXES(7)=1
136      IF (BOXES(7).GT.242)BOXES(7)=242
137      BOXES(8)=RIGHT
138      C      BOXES(36)=RIGHT
139      IF (BOXES(8).LT.#)BOXES(8)=IAND(BOXES(8),'377'0)
140      C      BOXES(8)=BOXES(7)+1#
141      IF (BOXES(8).GT.242)BOXES(8)=242
142      IF (TINDEX.EQ.#.AND.TFLAG.EQ.#)THEN
143      ICHANGEF=#
144      OBOX5=BOXES(5)
145      OBOX7=BOXES(7)
146      OBOX6=BOXES(6)
147      OBOX8=BOXES(8)
148      TFLAG=1
149      ENDIF
150      OBOX5P1=OBOX5+NOISE
151      OBOX6M1=OBOX5-NOISE
152      OBOX6P1=OBOX6+NOISE
153      OBOX6M1=OBOX6-NOISE
154      IF (OBOX5M1.GT.BOXES(5).OR.OBOX6P1.LT.BOXES(5)
155      1.OR.OBOX6M1.GT.BOXES(5).OR.OBOX6P1.LT.BOXES(6))THEN
156      C      TYPE =, ' TOP BOTTOM',OBOX5P1,OBOX5M1,OBOX7P1,
157      C      1OBOX7M1,BOXES(5),BOXES(7),TINDEX
158      OBOX5=BOXES(5)
159      OBOX6=BOXES(6)
160      ICHANGEF=1
161      ENDIF
162      OBOX7M1=OBOX7-NOISE
163      OBOX7P1=OBOX7+NOISE
164      OBOX8M1=OBOX8-NOISE
165      OBOX8P1=OBOX8+NOISE

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166      IF(OBOX7M1.GT.BOXES(7).OR.OBOX7P1.LT.BOXES(7)
167      1.OR.OBOXSM1.GT.BOXES(8).OR.OBOXSP1.LT.BOXES(8))THEN
168      C      TYPE =, ' LEFT RIGHT',OBOXSP1,OBOXSM1,
169      C      1OBOX7P1,OBOX7M1,BOXES(5),BOXES(7),TINDEX
170      OBOX7=BOXES(7)
171      OBOX8=BOXES(8)
172      ICHANGEF=1
173      ENDIF
174      IF(ICHANGEF.EQ.1)THEN
175      TINDEX=TINDEX+1
176      C      TYPE =, ' TINDEX=',TINDEX
177      IDAY=MD*188+TD*18+UD
178      IN=TH*18+UH
179      IM=TH*18+UM
180      SEC=FLOAT(TS1*18+US)+FLOAT(TS2)/18.+FLOAT(LS)/188.
181      1+FLOAT(HS)/1888.
182      WRITE(9)(BOXES(IG),IG=5,8),IDAY,IN,IM,SEC
183      ICHANGEF=8
184      C      WRITE(6,181)BOXES(5),BOXES(6),BOXES(7),BOXES(8)
185      181      FORMAT(1X,4(2X,06))
186      ENDIF
187      C      DO JK=9,48
188      C      BOXES(JK)=8
189      C      ENDDO
190      K = SYSSQIO(XVAL(1),XVAL(GRCHAN),XVAL(XLOC(IOS_WRITEVBLK)),
191      1IOSB,,,BOXES(1),XVAL(88),,...)
192      188      CONTINUE
193      GO TO 1
194      END
195      SUBROUTINE QASTTBS
196      BYTE C
197      EXTERNAL IOS_READVBLK,IOSM_NOECHO
198      EXTERNAL TTBSAST
199      INTEGER TTCHAN,SYSSQIO
200      CHARACTER*15 STRING
201      BYTE DATA(15)
202      EQUIVALENCE(DATA,STRING)
203      INTEGER*2 IOSB(4)
204      COMMON/CHAN/TTCHAN
205      K = SYSSQIO(XVAL(5),XVAL(TTCHAN),XVAL(XLOC(IOS_READVBLK)),IOSB,
206      1TTBSAST,C,DATA(1),XVAL(15),,...)
207      IF(.NOT.K)TYPE =, ' ERROR IN QASTTBS QIO'
208      RETURN
209      END
210      SUBROUTINE TTBSAST(C)
211      BYTE C
212      EXTERNAL IOS_READVBLK,IOSM_NOECHO,IOS_WRITEVBLK
213      INTEGER SYSSQIOV,ITCHAN,XRCHAN,IOSM_NOECHO,SYSSSETIMR
214      INTEGER SYSSQIO,SYSSWAITFR,TSCHAN,SYSSBINTIM
215      DOUBLE PRECISION QUAD
216      CHARACTER*16 TIME
217      DATA TIME/'#### ##:##:##.09'/
218      C      DATA TIME/'#### ##:##:##.09'/
219      ISTATUS=SYSSBINTIM(XDESCR(TIME),QUAD)
220      IF(.NOT.ISTATUS)TYPE =, ' ERROR IN TIME DELAY'

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221      ISTATUS=SYSSETIMR(XVAL(6),QUAD,,)
222      IF(.NOT.ISTATUS)TYPE *,' ERROR IN TIME DELAY'
223      ISTATUS=SYSWAITFR(XVAL(6))
224      IF(.NOT.ISTATUS)TYPE *,' ERROR IN TIME DELAY'
225      CALL QASTTBS
226      RETURN
227      END
228      SUBROUTINE QXRA(C)
229      BYTE C
230      TYPE *,' XRA# AST SERVICE ROUTINE>>>>>>>>'
231      RETURN
232      END

```

APPENDIX D

PROGRAM TO EVALUATE GROUND TRUTH COMPLETENESS


```

86      TIM(IC)=IMR
87      TSEC(IC)=SECR
88      TIDAY(IC)=IDAY
89      C      WRITE(6,67)IN,IM,SEC
90      67      FORMAT(IX,12,' ',12,' ',F6.2)
91      GO TO 2
92      188      TYPE = 'TOTAL NUMBER OF IRIGS=',IC
93      L=1
94      GO TO 1
95      765      TYPE = ' HIT RETURN TO CONTINUE IRIG SEARCH'
96      READ(5,764)ISEARCH
97      764      FORMAT(A)
98      L=1
99      1      K=SYSSGLOW(XVAL(1),XVAL(XRCHAN),XVAL(XLOC(IOS_READVBLK)),IOSB,
100      1,,IRIG(1),XVAL(6),...)
101      C      WRITE(6,567)X,V,IRIG(1),IRIG(2),IRIG(3)
102      567      FORMAT(IX,'X=',03.5X,'V=',03.1X,06.1X,06.1X,06.1X)
103      IF(IRIG(3))THEN
104      L=1
105      GO TO 1
106      ENDF
107      CALL IRIGCVT(IRIG,IN,IM,SEC)
108      LFLAG=#
109      C      TYPE = ' IN ,IM ,SEC =',IN,IM,SEC
110      2#      IF(IN.LT.TIM(L))THEN
111      IF(L.GT.1)THEN
112      3#      L=L-1
113      LFLAG=1
114      IF(IN.LT.TIM(L).AND.L.GT.1)GO TO 3#
115      GO TO 1
116      ENDF
117      GO TO 1
118      ENDF
119      IF(IN.EQ.TIM(L))GO TO 23
120      IF(LFLAG.EQ.1)GO TO 1
121      L=L+1
122      IF(L.GT.IC)THEN
123      PRINT 223,TIM(L),TIM(L),TSEC(L)
124      223      FORMAT(IX,'IRIG NOT FOUND=',12,' ',12,' ',F6.2)
125      PRINT 222,IN,IM,SEC
126      222      FORMAT(IX,' CURRENT IRIG=',12,' ',12,' ',F6.2)
127      IF(TIM(L).EQ.#.AND.TIM(L).EQ.#)GO TO 765
128      L=1
129      GO TO 1
130      ENDF
131      IF(TIM(L).EQ.#)GO TO 21
132      GO TO 2#
133      IF(IN.LT. TIM(L))GO TO 1
134      C      IF(IN.NE.TIM(L))GO TO 21
135      IF(IN.NE.TIM(L))THEN
136      L=L+1
137      GO TO 1
138      ENDF
139      IF(SEC.LT.TSEC(L))GO TO 1
140      C      BOXN=ISHFT(TIDAY(L),-12)

```

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111      C      WRITE(6,34)BOXN,L
112      C34    FORMAT(1X,Z4)
113      BOXN=(ISHFT(TIDAY(L),-12)-1)*4
114      TYPE = 'BOXN=',BOXN,L,TIDAY(L)
115      C      PRINT 1234,BOXN,L,TIDAY(L)
116      C      1234  FORMAT(1X,'BOXN=',I3,2X,I6,2X,O6)
117      BOXES(1+BOXN)=BOX(1,L)
118      BOXES(2+BOXN)=BOX(2,L)
119      BOXES(3+BOXN)=BOX(3,L)
120      BOXES(4+BOXN)=BOX(4,L)
121      K = SYS$QIO(XVAL(4),XVAL(XRCHAN),XVAL(XLOC(IOS_WRITEVBLK)),
122      1IOSB,...,BOXES(1),XVAL(8#),...)
123      L=L+1
124      GO TO 1
125      END
126      SUBROUTINE IRIGCVT(IRIG,IN,IM,SEC)
127      BYTE IN,IM
128      INTEGER*2 IRIG(6),HD,TD,UD,TH,UH,TM,UM,TS1,TS2,US,LS,MS
129      INTEGER*2 ISAVE(2)
130      C      HD=ISHFT(IRIG(1),-12)
131      C      TD=IAND(ISHFT(IRIG(1),-8),'F'X)
132      C      UD=IAND(ISHFT(IRIG(1),-4),'F'X)
133      TH=IAND(IRIG(1),'3'X)
134      UH=ISHFT(IRIG(2),-12)
135      TM=IAND(ISHFT(IRIG(2),-9),'7'0)
136      UM=IAND(ISHFT(IRIG(2),-5),'F'X)
137      TS1=IAND(ISHFT(IRIG(2),-2),'7'0)
138      ISAVE(1)=IAND(ISHFT(IRIG(2),2),'C'X)
139      ISAVE(2)=ISHFT(IRIG(3),-14)
140      US=IOR(ISAVE(1),ISAVE(2))
141      TS2=IAND(ISHFT(IRIG(3),-1#),'F'X)
142      LS=IAND(ISHFT(IRIG(3),-6),'F'X)
143      MS=IAND(ISHFT(IRIG(3),-2),'F'X)
144      C      IRIG2=ISHFT(IRIG2,-2)
145      IN=TH*1#+UH
146      IM=TM*1#+UM
147      SEC=FLOAT(TS1*1#+US)+FLOAT(TS2)/1#.+FLOAT(LS)/1##.
148      1+FLOAT(MS)/1###.
149      RETURN
150      END

```

APPENDIX E

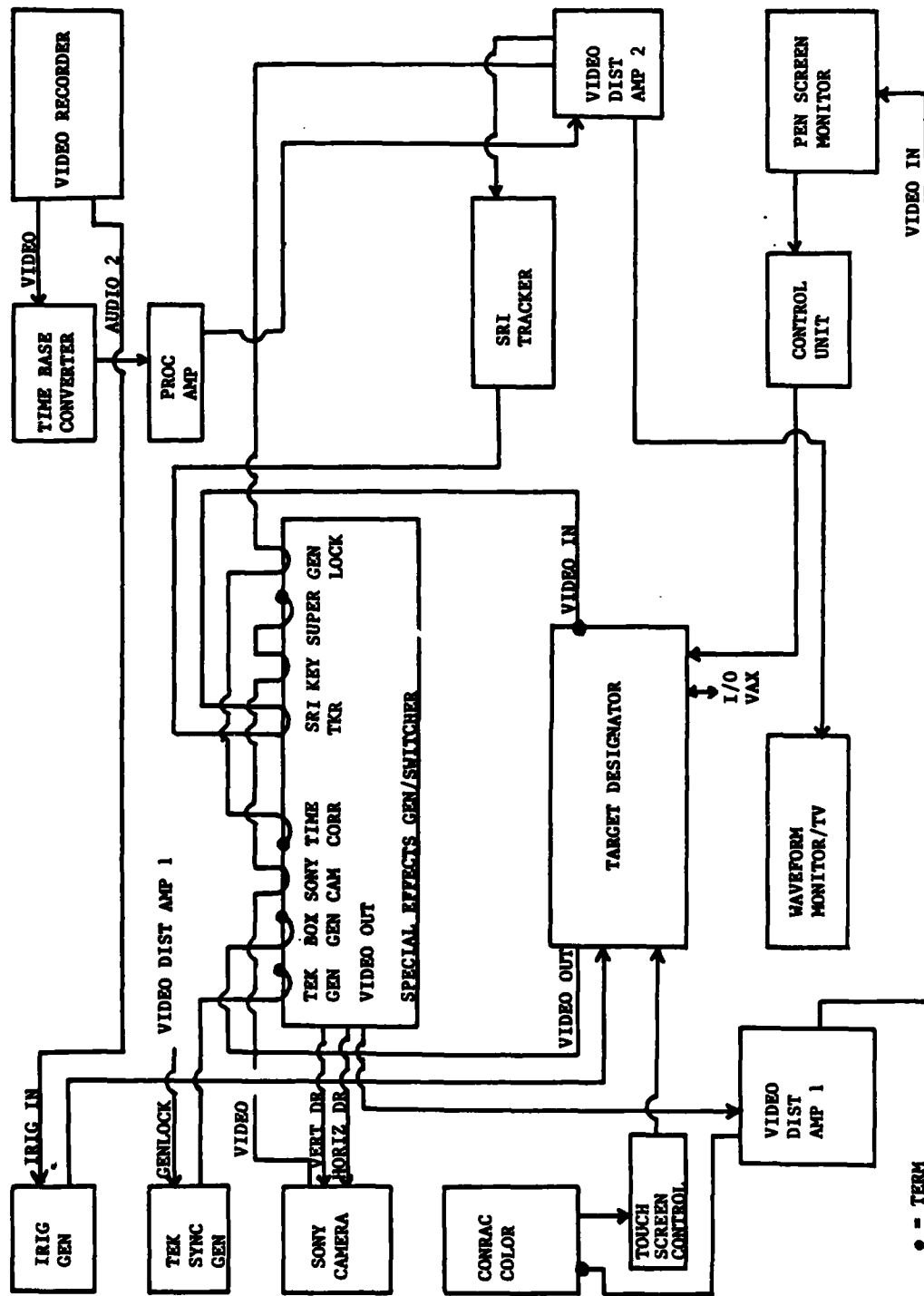
DESCRIPTION OF TARGET DESIGNATOR/CUEING HARDWARE

DESCRIPTION OF TARGET DESIGNATOR/CUEING HARDWARE

The target designator/operator cueier or "Box Generator" has been designed to enable frame-by-frame target priority designation under computer control with video insertion built into the unit. The following features are available for use.

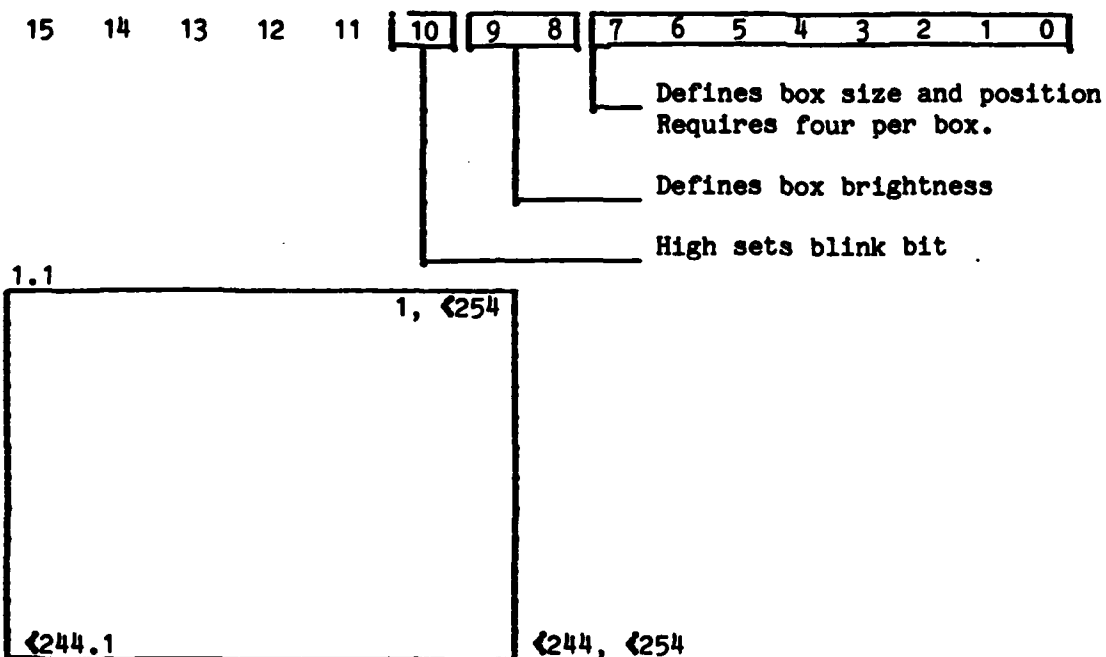
- a. Ten targets can be cued at one time.
- b. Each target can be outlined in white. The whole area inside (Box 8) will be increased in brightness.
- c. There are five levels of prioritization cues available for use on the first 4 targets.
 1. The highest level is when the blink bit is enabled on Box One. This will cause the box surrounding that target to go off and on.
 2. There are four levels of brightness that can be set under computer control. This feature could, for example, be used to indicate a level of confidence in an automatic target selection process or to indicate the relative importance of different targets.

A block diagram of the overall acquisition system is shown in Figure E-1. The box representing the target designator/cueing hardware along with its different input-output signals is shown in the lower center of the figure. The following is a description of the use and meaning of data words into the target designator. The VAX-11/780 sends a 16 bit word through the DR11-B interface board to the target designator (TD). The first five high order bits are not used in the TD. Bit ten when high sets blink bit to Box 1. Box 1 is the only box that can be made to blink. Bit nine and bit eight control the brightness of four boxes, one through four. Bit value "0 0" is just brighter than the six boxes. Bit value "11" is the maximum brightness available. There can only be one box of each brightness. Bits seven through bit zero defines box position and box size. The size and position values are to be sent out in the following order, left side, right side, top side, and bottom side. The range and order of data is shown on the following page.



• - TERM

Figure E-1. System block diagram.



Values to set blink and brightness are set as part of left value for first four boxes. Blink is valid only for first box. Bits eight and nine have the following values.

Bit values for use for first four boxes, left side out only.

10	9	8
----	---	---

0	0	0	No blink, minimum brightness
0	0	1	
0	1	0	
0	1	1	No blink, max brightness
1	0	0	Blink, box one only, minimum brightness
1	0	1	
1	1	0	
1	1	1	Blink, box one only, max brightness

RESET is initiated for 120 Nsec. from sync. interface control before up to forty unit values are output from DR11-B.

The following is a brief description of the target designator block diagram.

a. Latch address generation (Figure E-2)

A counter capable of storing more than forty numbers is first reset at beginning of sequence. This generates an address of zero. Data is put on the lines and LOAD DATA is initiated. This loads data into various latches that represent left side, blink and brightness. INC. then increments the latch address counter. This is continued until forty data words are loaded.

b. Data Reg and comparators (Figure E-3)

The data registers are loaded under the control of the latch address counter. The data register outputs are connected to high speed comparators where the values are compared against pixel count and line count. These comparators give signals out that indicate equal-to, greater-than, or less-than, for left, right, up and down. The signals are combined in high speed logic to derive boxes that are inserted into the video to indicate target position, size, and importance.

c. Pixel and line counters (Figure E-4)

The pixel and line counters generate counts corresponding to position on the TV screen. The composite blanking and vertical drive signals must be phase locked to the video signal of interest. These counter values are then sent to the comparators to generate box size and position.

d. Brightness select, blink, and video insert (Figure E-5)

Four unique select signals from left edge load on the first four boxes causes data bits on eight, nine, and ten to cause blinking on one and intensity modulation on one through four. These signals are then fed into a video amplifier where they are inserted into the video.

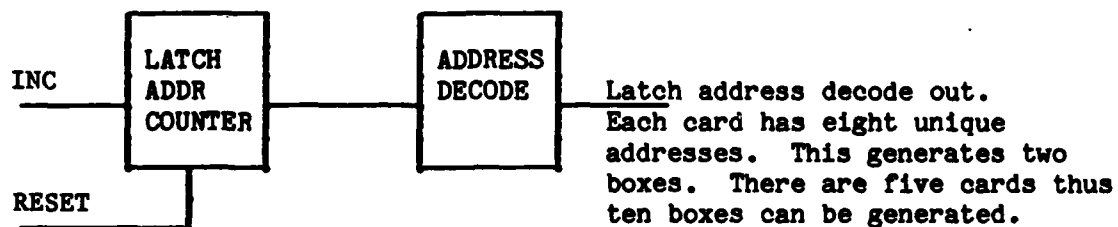


Figure E-2. Latch address generation.

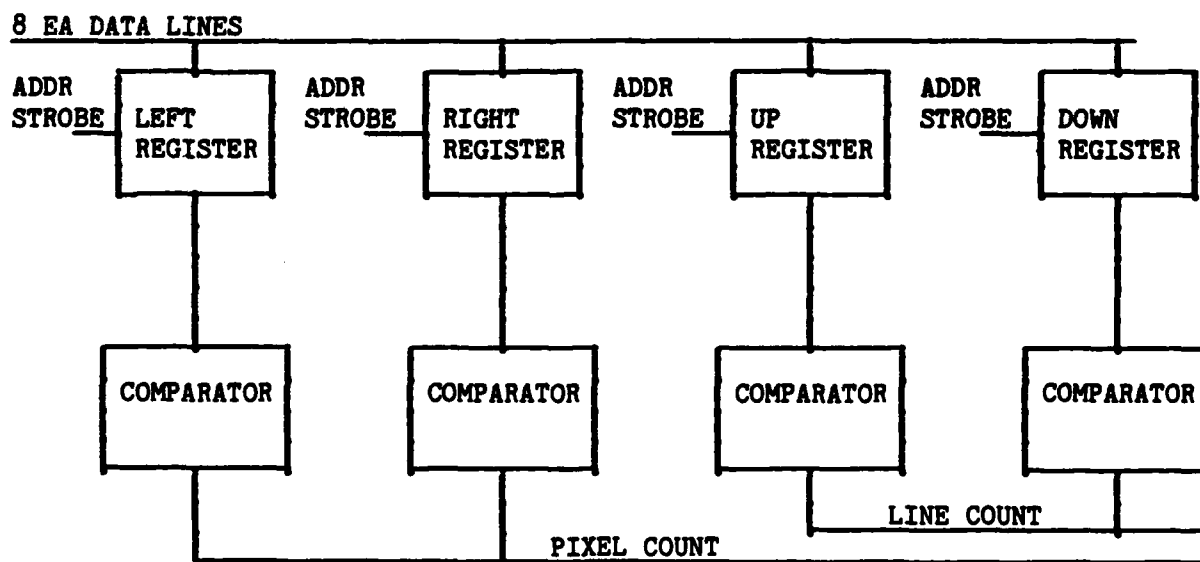


Figure E-3. Data reg and comparators.

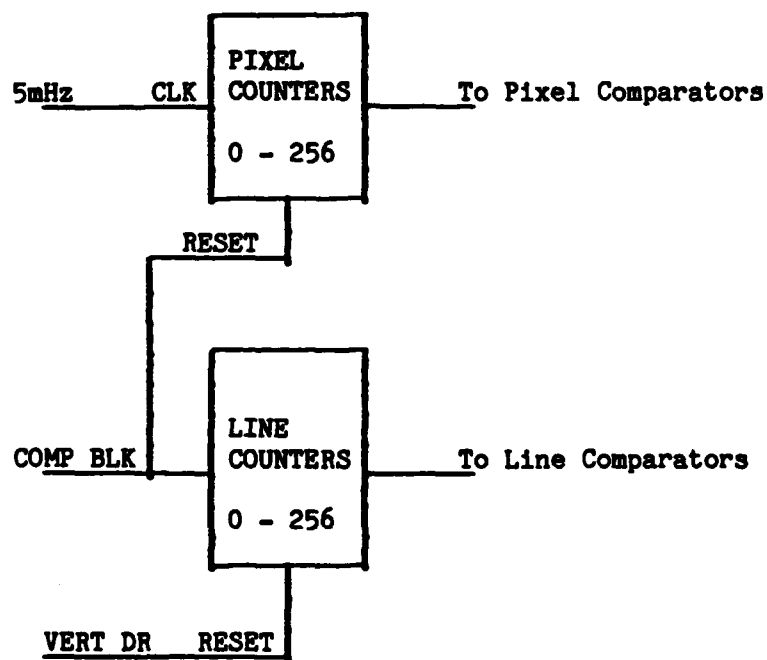


Figure E-4. Pixel and line counters.

Four unique selects from left
edge load on first four boxes

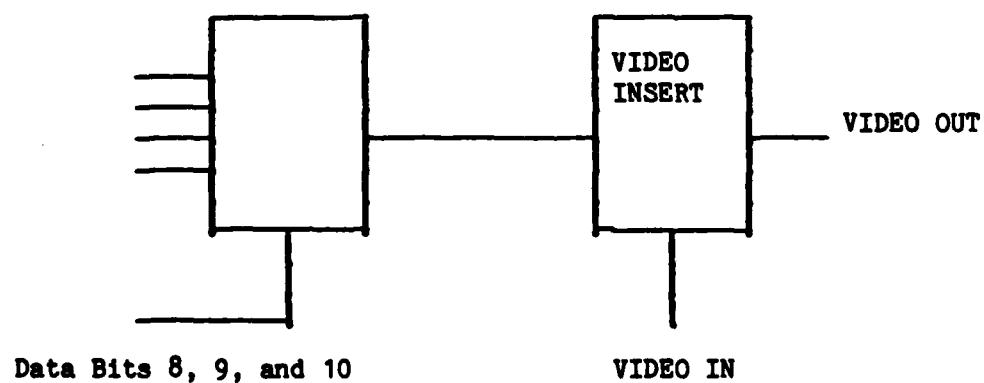


Figure E-5. Brightness select, blink, and video insert.

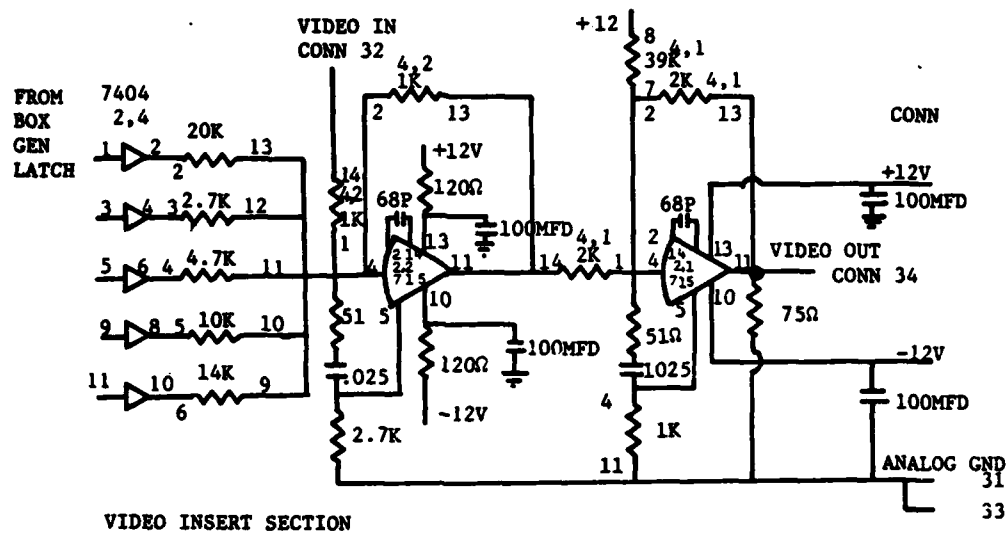
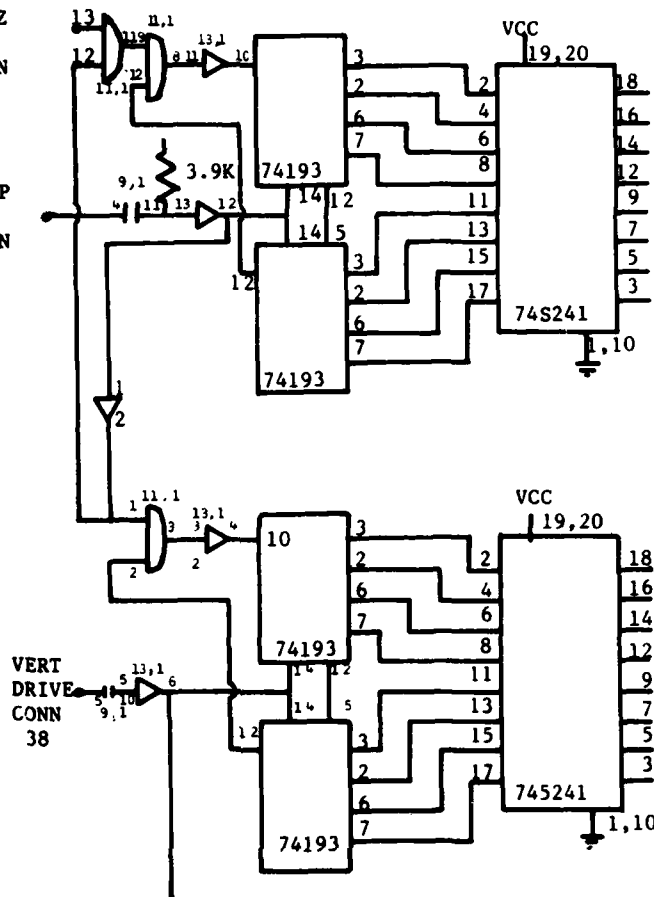


Figure E-6. Continued.

LINE AND PIXEL
COUNTERS
SECTION

5MHZ
CLK
CONN
39

COMP
BLK
CONN
37



CONN

40LSB

41

42

43PIXEL

44COUNT

45

46

47MSB

CONN

48

48

50

51LINE

52COUNT

53

54

55

LATCH ADDRESS
COUNTER SECTION

CONN

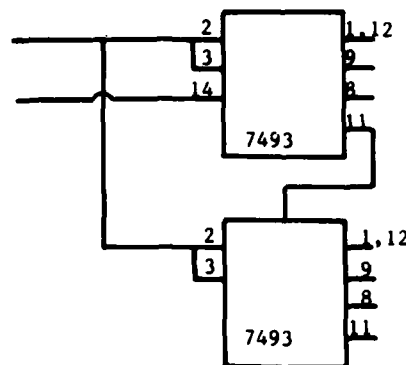
27

CONN

26

RESET

INC.



CONN

15

16

17

18

19

20

Figure E-6. Continued.

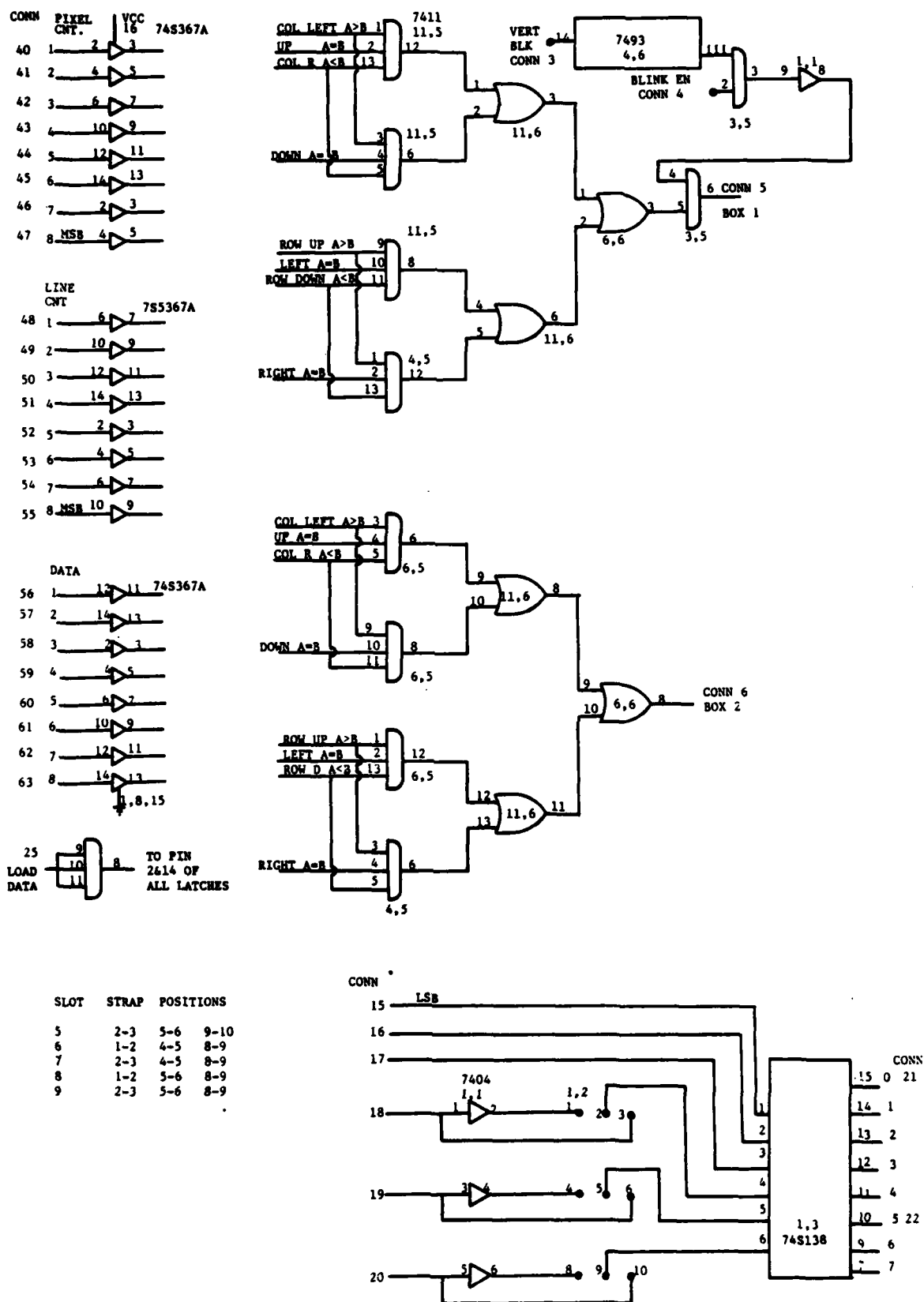


Figure E-7. Schematic of address select and box gen logic.

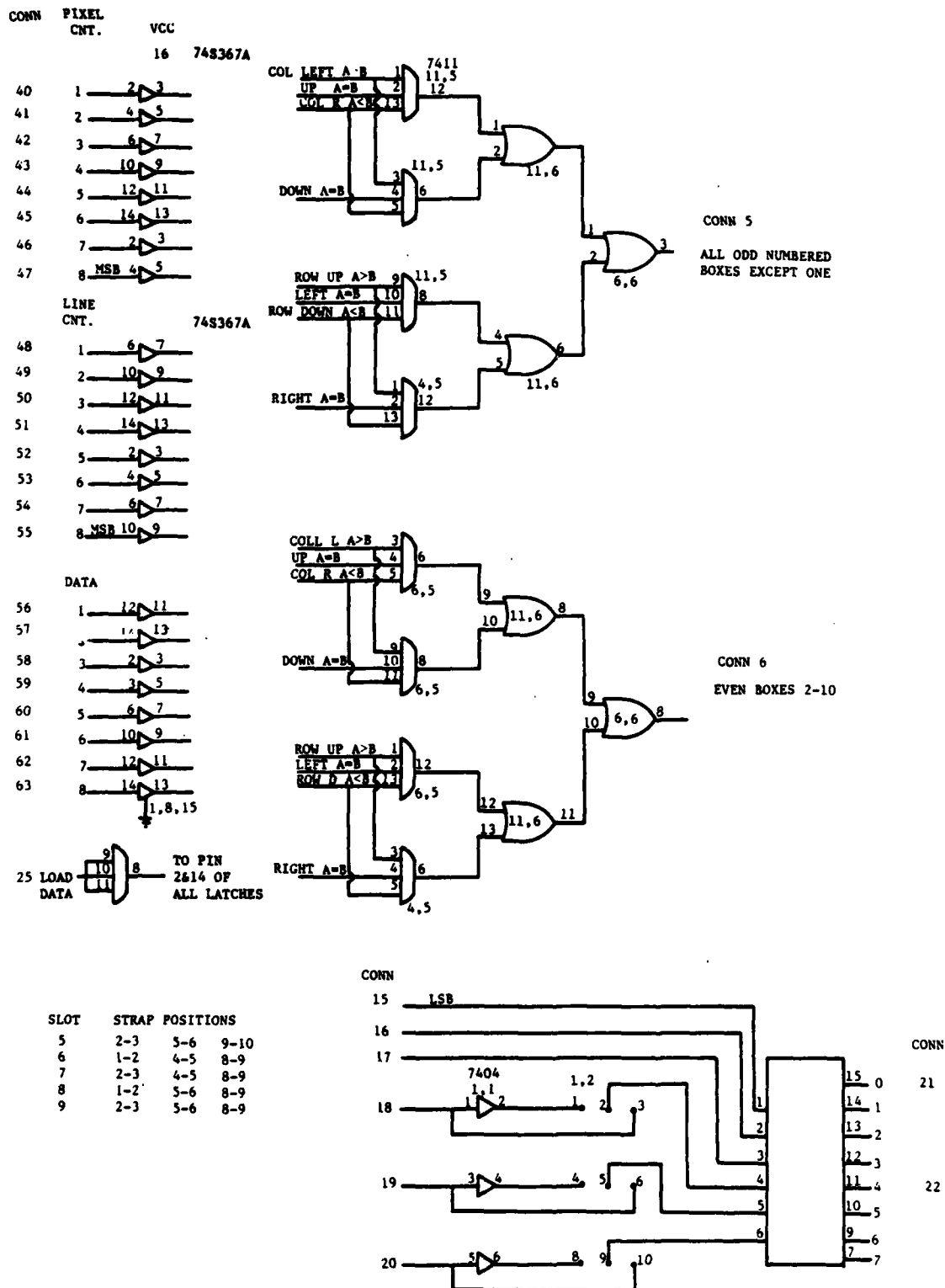


Figure E-7. Continued.

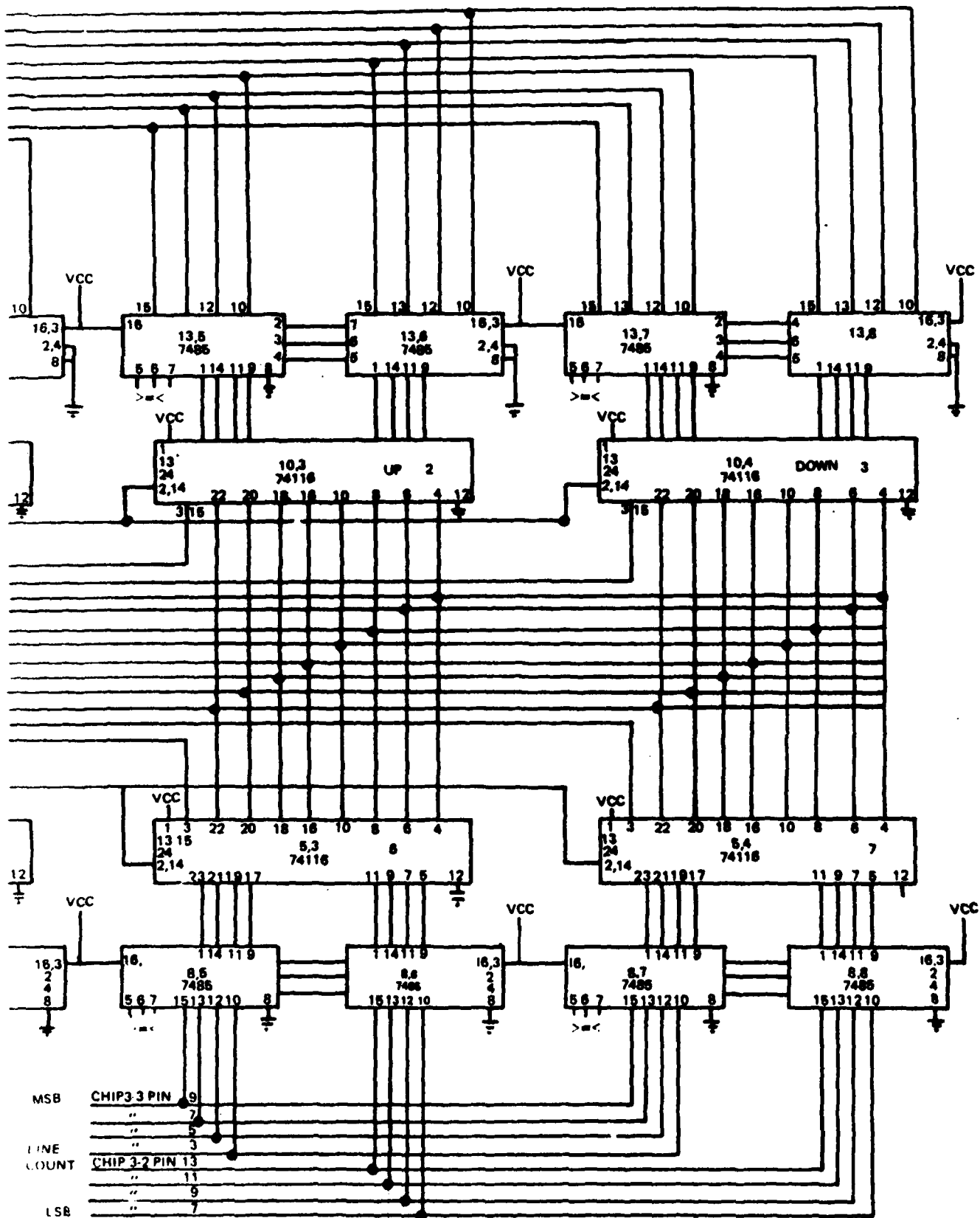
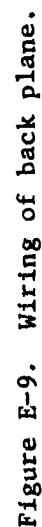


Figure E-8. Schematic data registers and comparators.

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APPENDIX F

DESCRIPTION OF TRACKER INTERFACE AND CONTROL UNIT

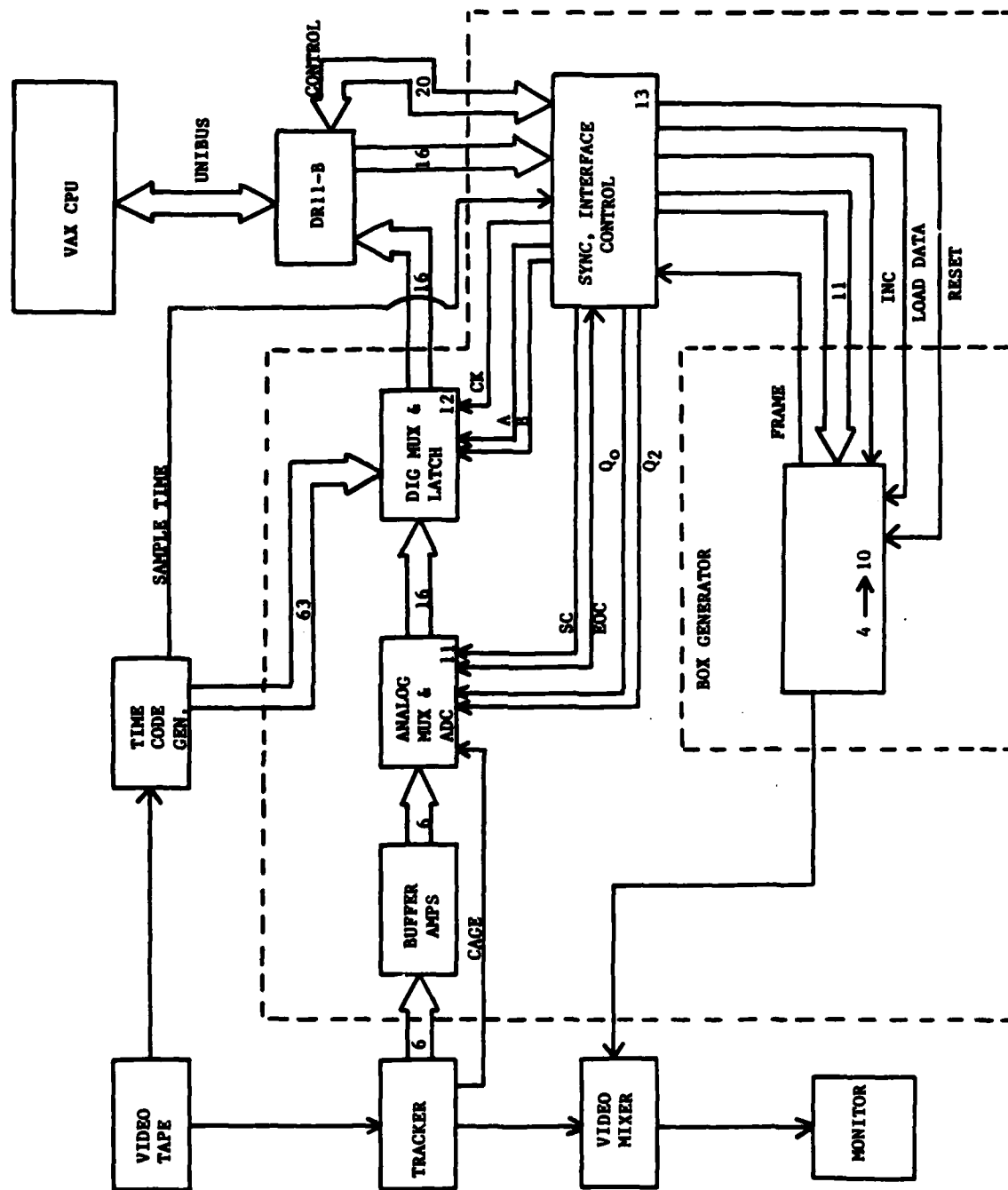


Figure F-1. Interface and control unit block diagram.

TRACKER INTERFACE AND CONTROL UNIT

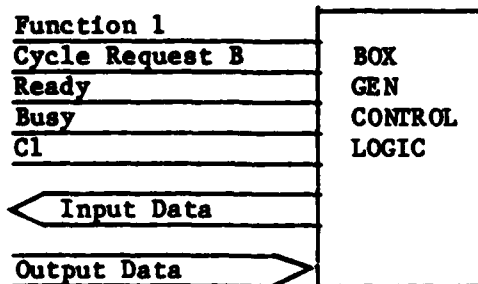
A block diagram of the interface and control unit along with its relation to other elements in the data acquisition system is shown in Figure F-1. This interface is fabricated on three separate circuit cards — a sync interface control board, a digital converter/multiplexer and latch board, and an analog to digital converter/multiplexer. The key element is the SYNC interface card. The SYNC-interface card performs the basic functions listed below.

- Generation of SYNC and timing signals for the Box-GEN.
- Interfacing of data and instructions output from the computer to the box-GEN.
- Interfacing of data input to the computer from the box-GEN.

The following signals are required for the transfer of data between the DR11-B and the box-GEN.

Signal	LOGIC 0 (Inactive)	LOGIC 1 (Active)
Cl (read/write, word)	0 VDC	+5 VDC (TTL)
Cycle Request B	0 VDC	+5 VDC (TTL)
Function 1 (read/write)	0 VDC	+5 VDC (TTL)
Ready	+5 VDC	0 VDC (TTL)
Busy	0 VDC	+5 VDC (TTL)
Output Data (16 lines)	0 VDC	+5 VDC (TTL)
Input Data (16 lines)	0 VDC	+5 VDC (TTL)

Box generator unidirectional interface to a DEC DR11-B



Function 1: This signal is returned as Cl control through two inverters and cable driver. When active, it indicates that the data transfer will be an input to the CPU from the Box GEN. When inactive, it indicates that the data transfer will be an output from the CPU to the Box-GEN.

Ready: When this signal becomes false (inactive), the DR11-B is ready to transfer data to/from the Box-GEN. When Function 1 is inactive, the Box-GEN will respond with a cycle request B to indicate it can accept an output data transfer. When function 1 is active, the Box-GEN will respond with a cycle request B to indicate it has an input data word ready for transfer.

Busy: This signal indicates that a bus sequence is in progress. The trailing edge of this signal is used to initiate subsequent output/input data requests. This trailing edge is also used to load output data into the Box-GEN during output data transfers.

Output Data Bus: The 16-bit positive true data bus output from the computer is input to card 13 at right side of page. Rising edge of "LOAD DATA" and "INC" on card 13 is used to load data in registers and increment address. "RESET" resets address register when ready first goes low for 120 nsec.

Input Data Bus: The 16 bit positive true data bus input to the computer is on card 12 left side of page. Data is latched and multiplexed on this card. ADC inputs come from intercard cable. The falling edge of busy increments two counters on card 13 for address generation. Address "A" and "B" are used for time code digital multiplexing and address "Qo" and "Q2" are used for analog multiplexing on input of ADC Card 11. (Refer to timing diagram in read mode.) The first start convert (SC) is generated during address 0 and cycle request. The last two start converts begin at falling edge of busy and the last two cycle request begin at end of convert (EOC). A BCD counter is used to select number of frame delays before generating first cycle request. The input to the ADC multiplexer has 6 buffer amps. Each buffer amp has balance and amplitude POT adjustments.

Figures F-2 through F-11 are the schematic and timing diagrams for the cards in the interface and control unit.

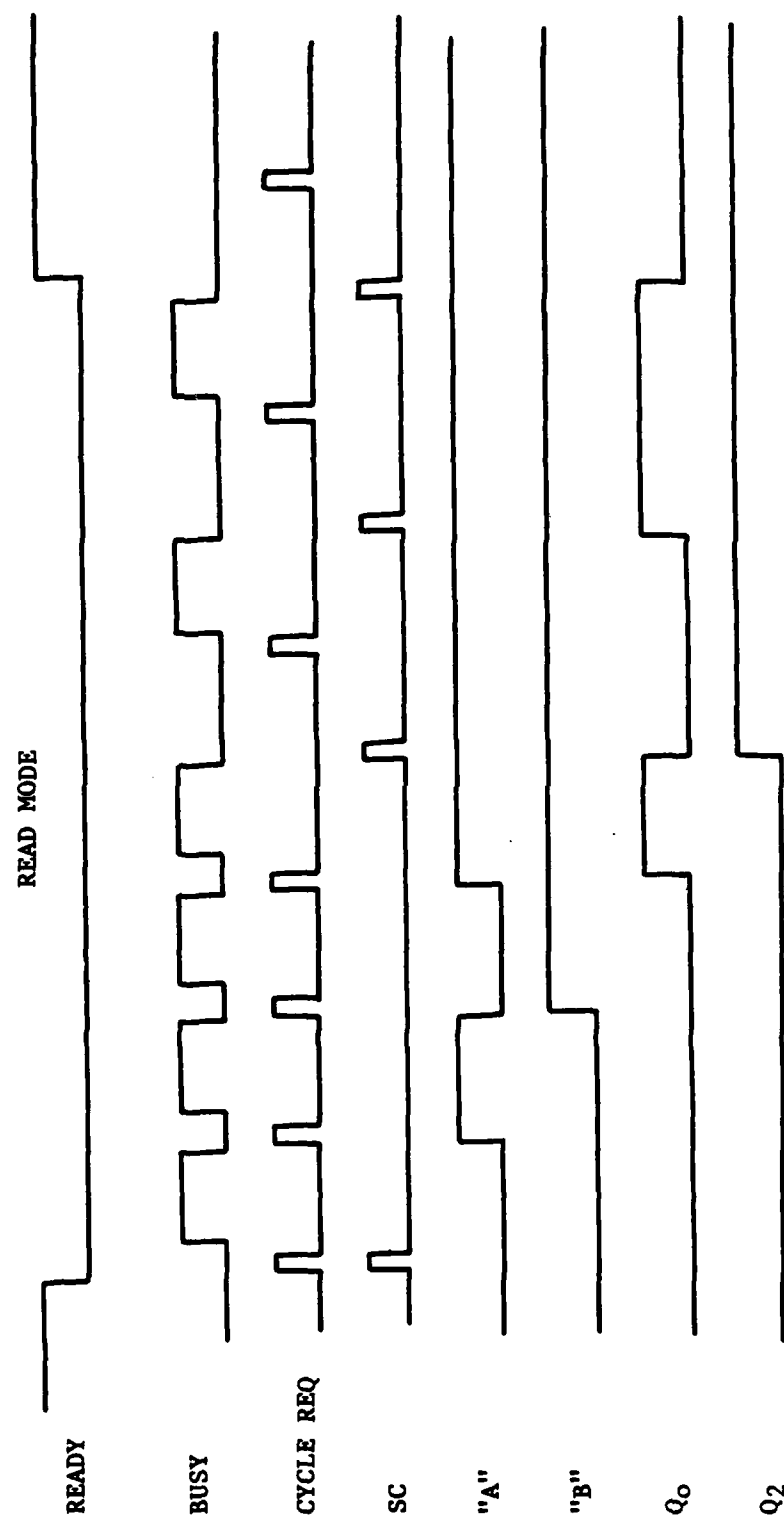


Figure F-2. Read mode timing diagram.

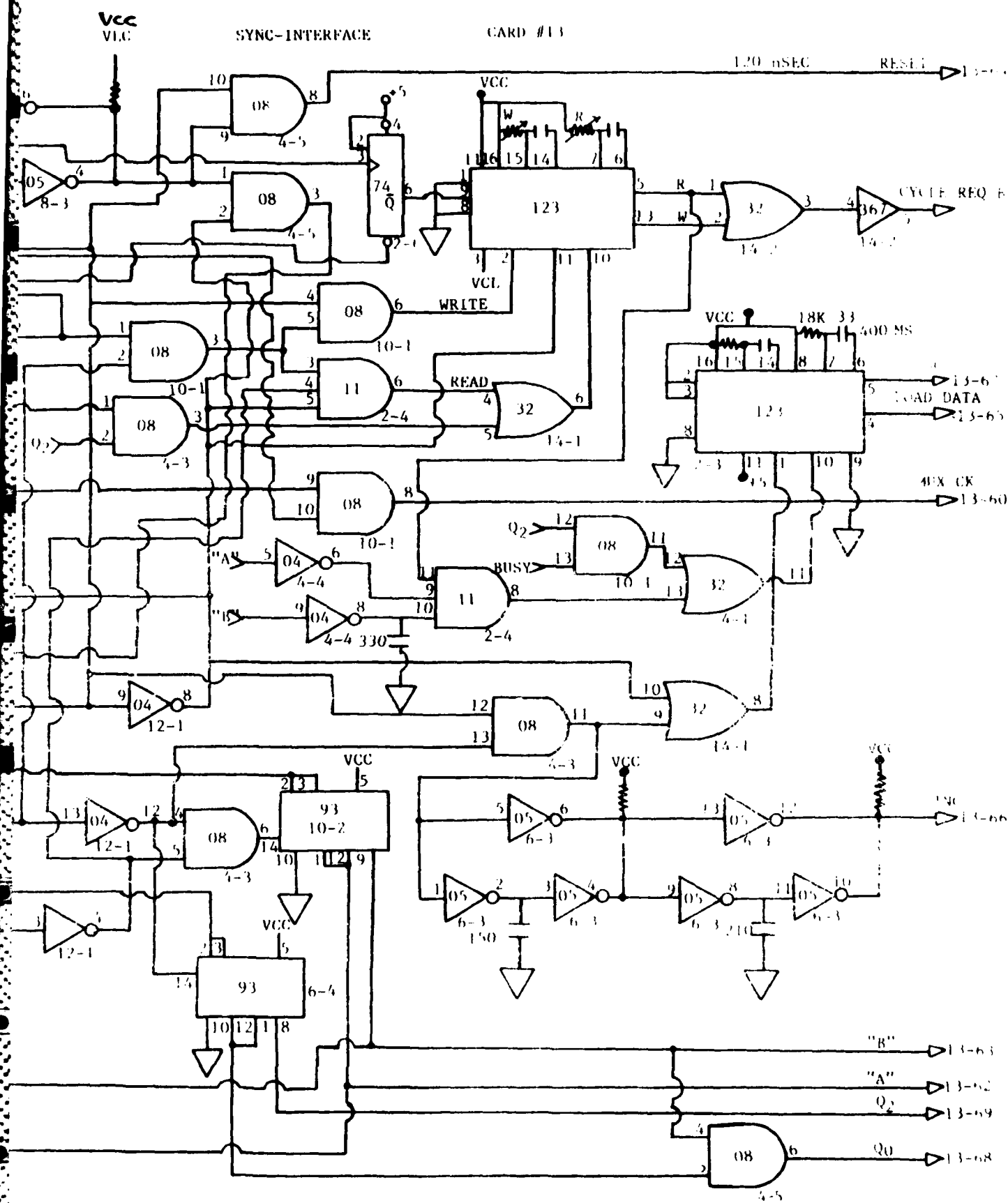


Figure F-3. Sync-Interface, card #13 schematic sheet 1 and sheet 2.

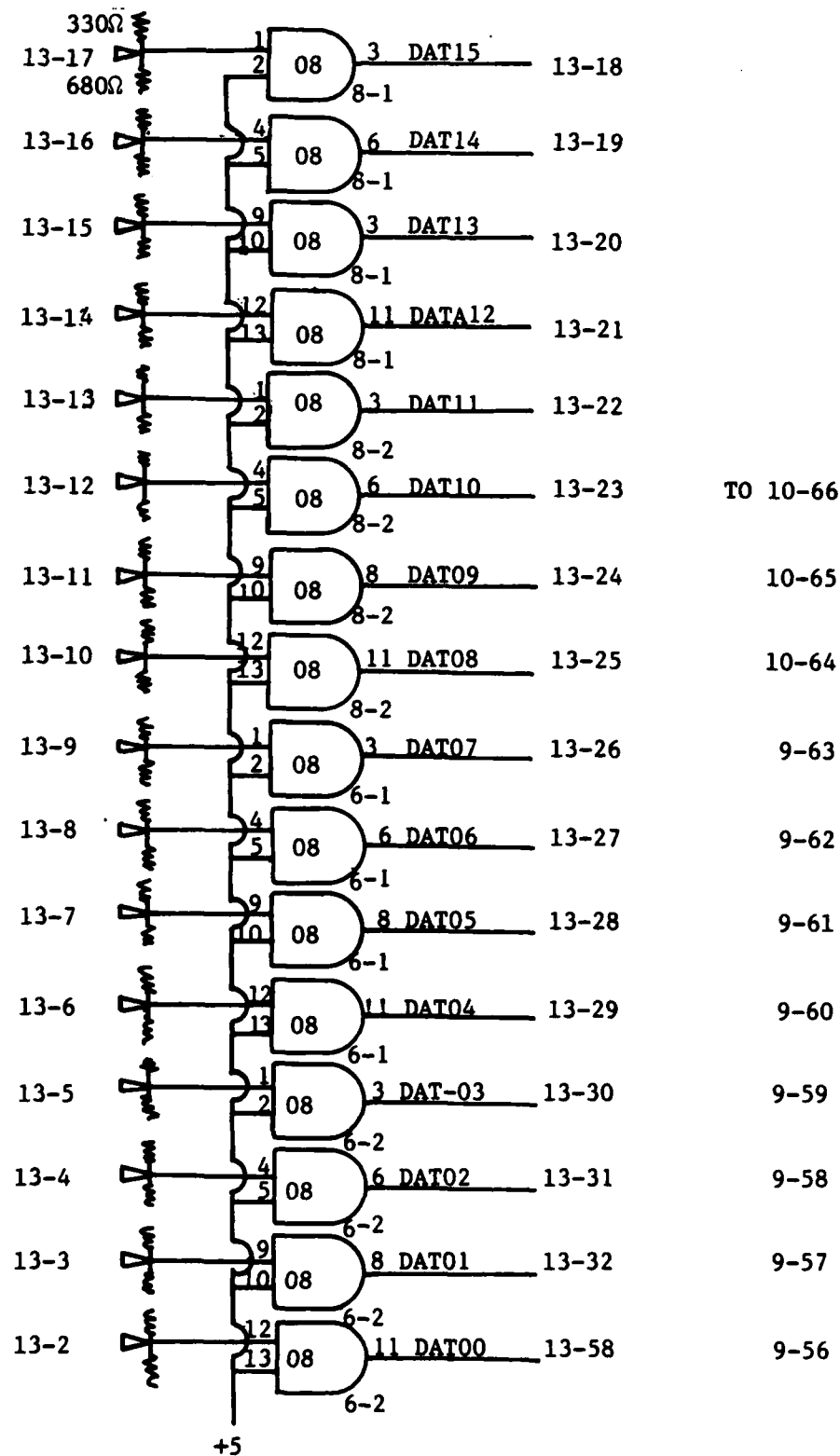


Figure F-3. Continued.

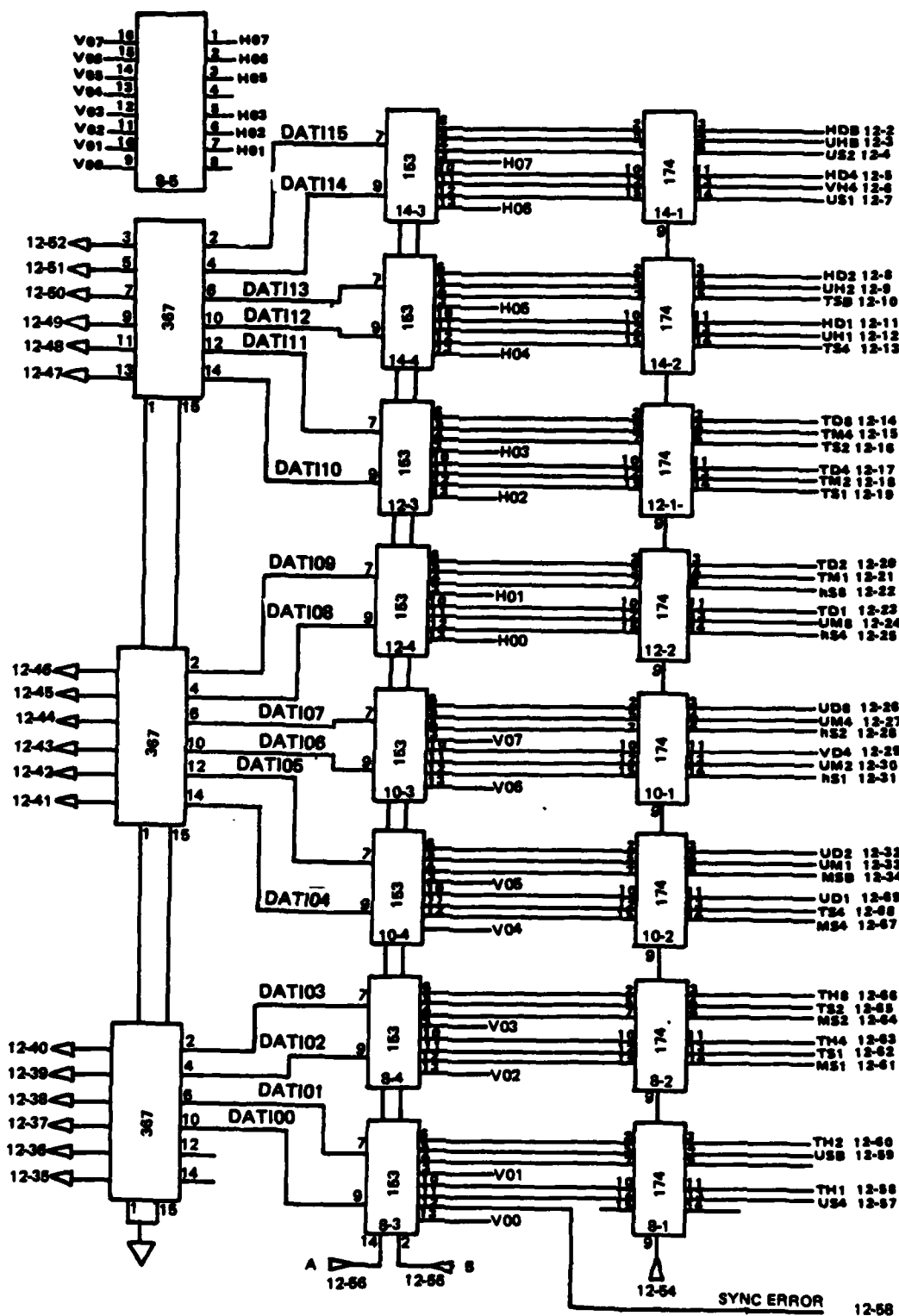


Figure F-4. Latch-multiplexer-cable driver, card #12 schematic.

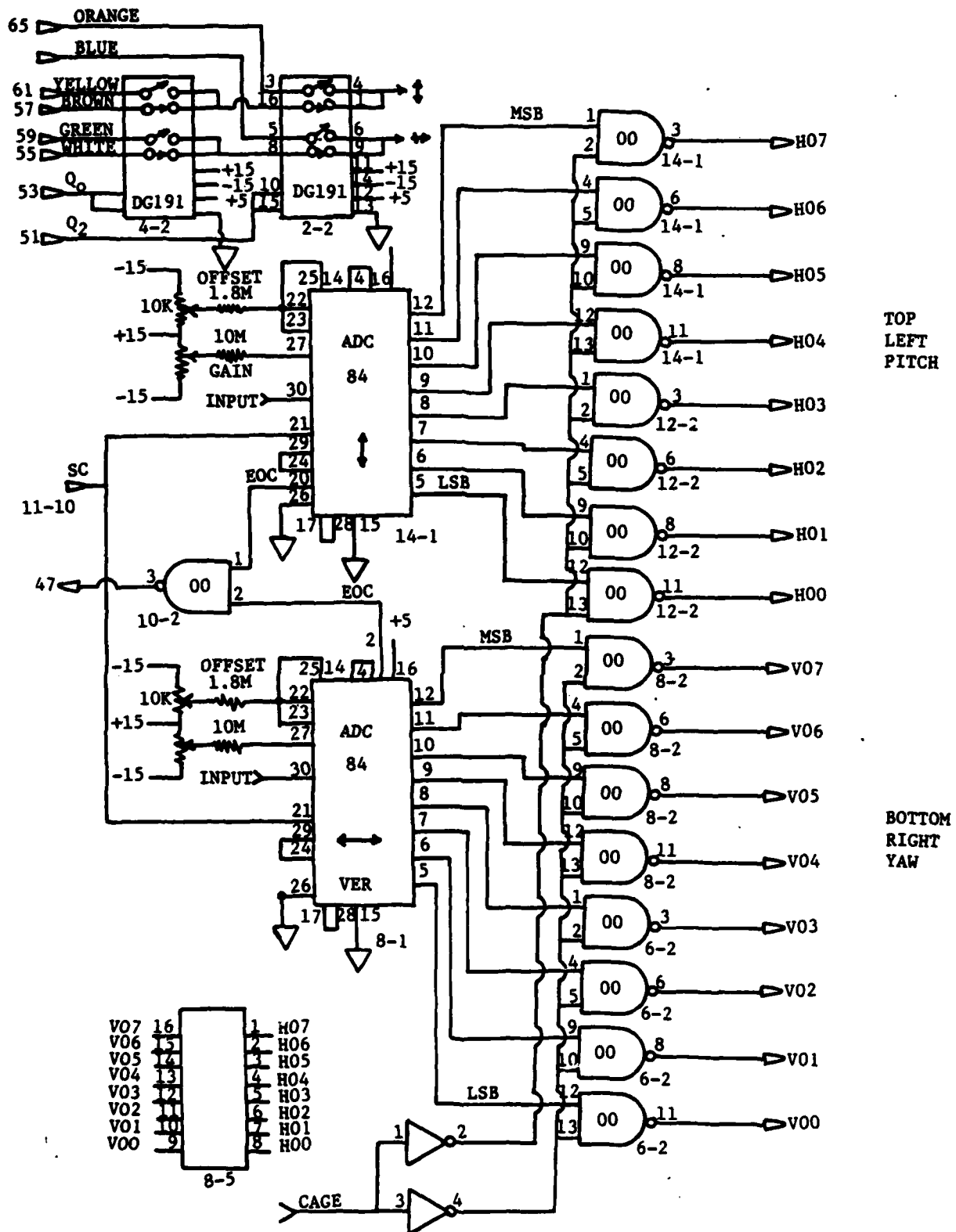


Figure F-5. Analog-multiplexer ADC, card #11 schematic.

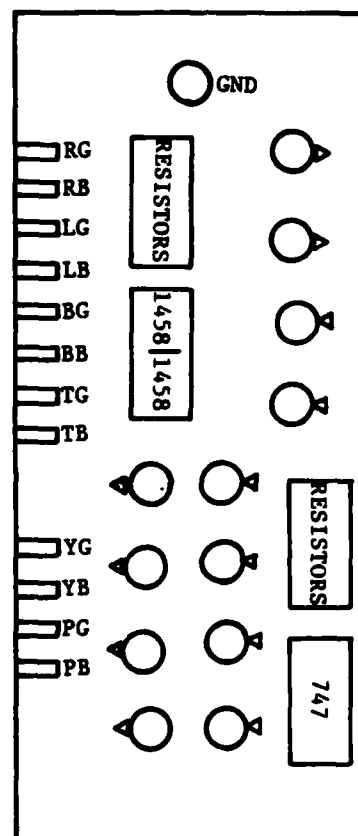
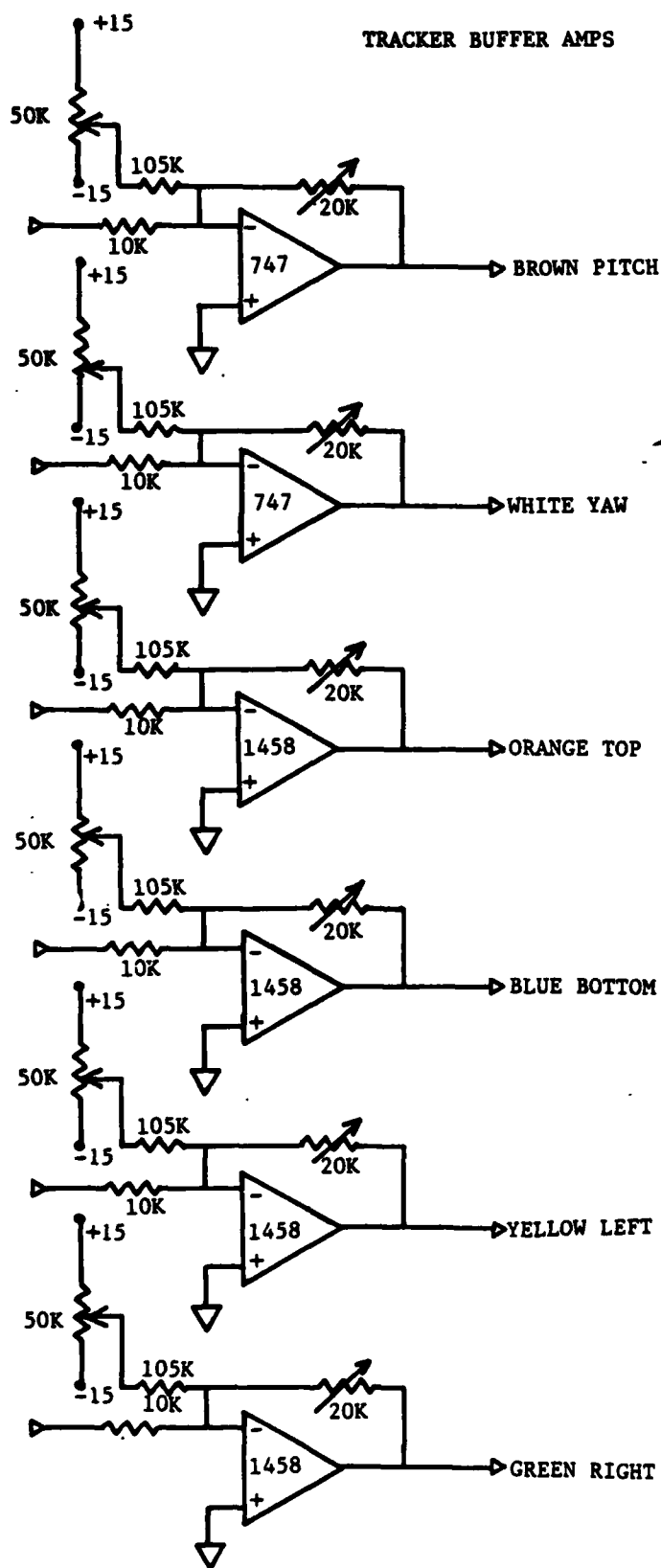


Figure F-6. Tracker buffer amplifier schematic.

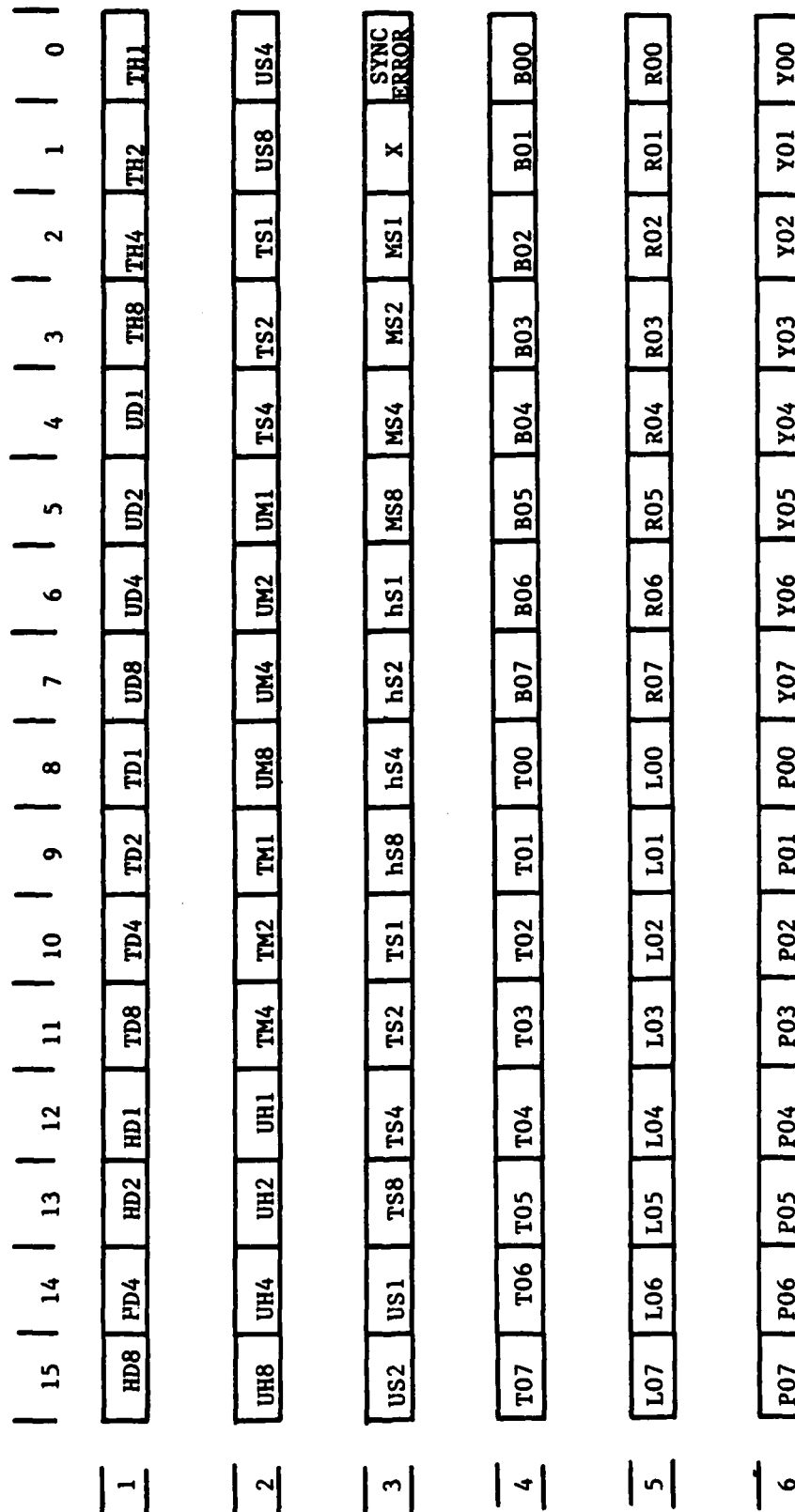
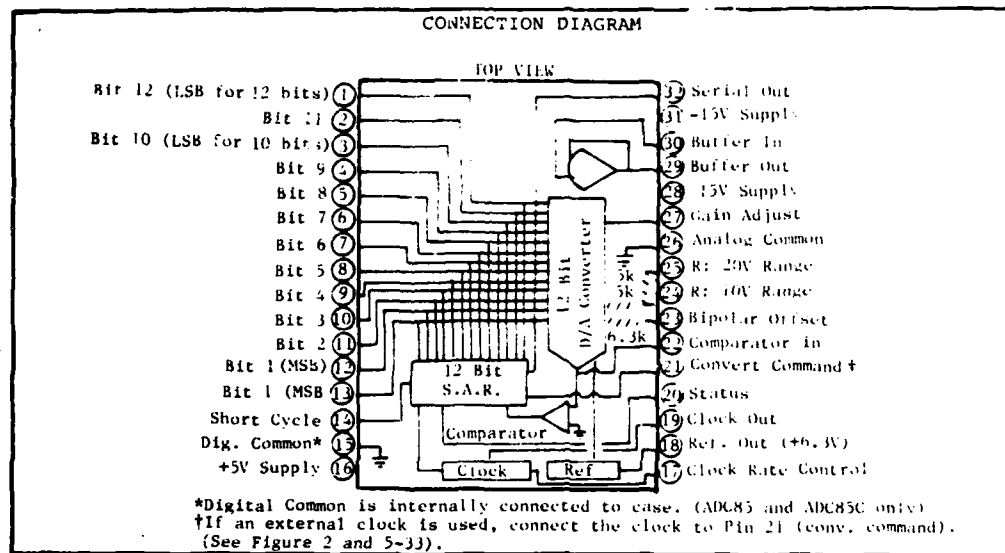


Figure F-7. Read data format diagram.



Binary (BIN) Output	INPUT VOLTAGE RANGE AND LSB VALUES					
Analog Input Voltage Range	Defined As:	+10V	+5V	+2.5V*	0 to +10V	0 to +5V
Code Designation		COB* or CTC***	COB* or CTC***	COB* or CTC***	CSB**	CSB**
One Least Significant Bit (LSB)	FSR 2* n=8 n=10 n=12	20V 2* 78.13mV 19.53mV 4.88mV	10V 2* 39.06mV 9.77mV 2.44mV	5V 2* 19.53mV 4.88mV 1.22mV	10V 2* 39.06mV 9.77mV 2.44mV	5V 2* 19.53mV 4.88mV 1.22mV
Transition Values MSB LSB 000 . . . 000**** 011 . . . 111 111 . . . 110	+Full Scale Mid Scale -Full Scale	+10V-3 2LSB 0 +10V+1 2LSB	+5V-3 2LSB 0 -5V+2LSB	+2.5V-3 2LSB 0 -2.5V+1 2LSB	+10V-3 2LSB +5V 0+1 2LSB	+5V-3 2LSB +2.5V 0+1 2LSB

*COB=Complementary Offset Binary

**CSB=Complementary Straight Binary

***CTC=Complementary. Two's complement-obtained by using the complement of the most significant bit (MSB) is available on pin 13.

**** Voltages given are the nominal value for transition to the code specified.

*USED IN THIS DESIGN

Input Signal Range	Output Code	Connect Pin 23 To Pin	Connect Pin 25 To	For Buffered Input* Connect Pin 29 To Pin	For Direct Input (See note) Connect Input Signal To Pin
+10V	COB or CTC	22	Input Signal**	25	25
+5V	COB or CTC	22	Open	24	24
+2.5V	COB or CTC	22	Pin 22	24	24
0 to +5V	CSB	26	Pin 22	24	24
0 to +10V	CSB	26	Open	24	24

*Connect to Pin 29 or input signal as shown in next two columns.

**The input signal is connected to Pin 30 if the buffer amplifier is used.

NOTE: If the buffer amplifier is not used, the input Pin 30 must be grounded (Pin 26).

TABLE 1. INPUT VOLTAGES, TRANSITION VALUES, LSB VALUES, AND CODE DEFINITIONS

Figure F-8. A-D converter specifications.

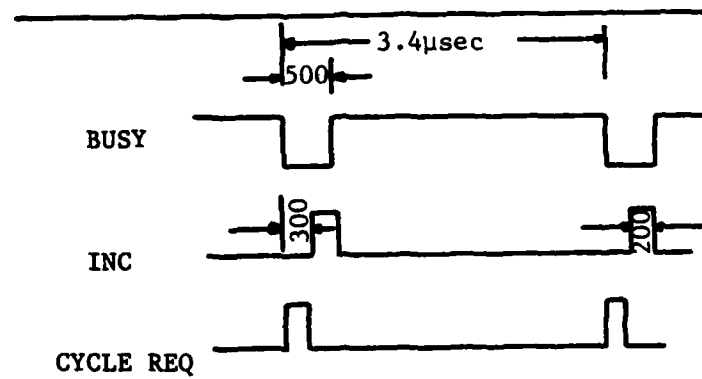


Figure F-9. Write mode timing diagram.

P1				P2			
13-37	KK	A001N	18	13-48	DD	END CYCLE	39
11-44	U	DATI07	16	49	BB	CYCLE REQB	37
43	R	DATI06	14	50	Z	FNCT 30	35
42	N	DATI05	12				33
41	L	DATI04	10	51	<u>Y</u>	FNCT20	31
40	J	DATI03	8	52	<u>U</u>	FNCT10	29
39	E	DATI02	6				27
38	C	DATI01	4	53	HH	0+5	25
12-39	A	DATI00	2	54	<u>S</u>	READY0	23
		CYCLE REQ A	39	55	<u>P</u>	WC INC ENB	21
13-38	NN	GOO	37	13-56	<u>m</u>	INIT0	19
39	<u>X</u>	DSTATA	35	10	<u>K</u>	ODAT08	15
40	DD	SINGLE CYCLE	33	11	<u>f</u>	ODAT09	13
41	BB	DSTATE	31	12	<u>e</u>	ODAT10	11
42	Z	DSTATC	29	13	H	ODAT11	9
43	<u>U</u>	C1 CONTROL	27	14	<u>C</u>	ODAT12	7
44	HH	BUSY 0	25	15	<u>a</u>	ODAT13	5
		SPARE	23	16	<u>Y</u>	ODAT14	3
45	<u>S</u>	BA INC ENB	21	13-17	W	ODAT15	1
46	<u>P</u>	ATTN	19	13-57	KK	NO LOCK	28
13-47	<u>M</u>	CO CONTROL IN	17	13-9	U	ODAT07	16
12-45	<u>K</u>	DATI08	15	8	R	ODAT06	14
46	<u>f</u>	DATI09	13	7	N	ODAT05	12
47	<u>e</u>	DATI10	11	6	L	ODAT04	10
48	H	DATI11	9	5	J	ODAT03	8
49	<u>C</u>	DATI12	7	4	E	ODAT02	6
50	<u>a</u>	DATI13	5	3	C	ODAT01	4
51	<u>Y</u>	DATI14	3	13-2	A	ODAT00	2
12-52	W	DATI15	1				

Figure F-10. Interface and control connector.

BOX GEN		IRIG A/N	SIGNAL
A	RED	A	HD2
B	YEL	B	HD1
C	RED	C	TD8
D	GRE	D	TD4
E	RED	E	TD2
F	BLU	F	TD1
J	RED	H	UD8
K	BLK	J	UD4
L	RED	K	UD2
M	WHT	L	UD1
N	RED	M	TH2
P	BRO	N	TH1
R	RED	P	UH8
S	ORA	R	UH4
U	GRE	S	UH2
V	BRO	T	UH1
KK	WHT	U	TM4
LL	BRO	V	TM2
W	GRE	W	TM1
X	YEL	X	UM8
Y	GRE	Y	UM4
Z	ORA	Z	UM2
a	GRE	AA	UM1
b	WHT	AB	TS4
c	GRE	AC	TS2
d	BLU	AD	TS1
H	YEL	AE	US8
T	BLU	AF	US4
e	GRE	AH	US2

BOX GEN		IRIG P/N	SIGNAL
h	BLK	AJ	US1
f	BLU	AK	ts8
J	SHT	AL	ts4
k	BLU	AM	ts2
L	ORA	AN	ts1
M	BLU	AP	hs8
N	BRO	AR	hs4
P	BLU	AS	hs2
R	BLK	AT	hs1
S	YEL	AU	ms8
T	BRO	AV	ms4
HH	WHT	AW	ms2
JJ	BLK	AX	ms1
U	YEL	BF	SAMPLE TIME
V	BLK	BJ	GND
X	YEL	BK	GND
Y	WHT	BL	GND
Z	ORA	BM	GND
AA	BRO	BN	GND
NN	BRO	BW	SYNC ERROR
BB		CA	HD8
CC		CB	HD4
DD		CC	TH8
EE		CD	TH4

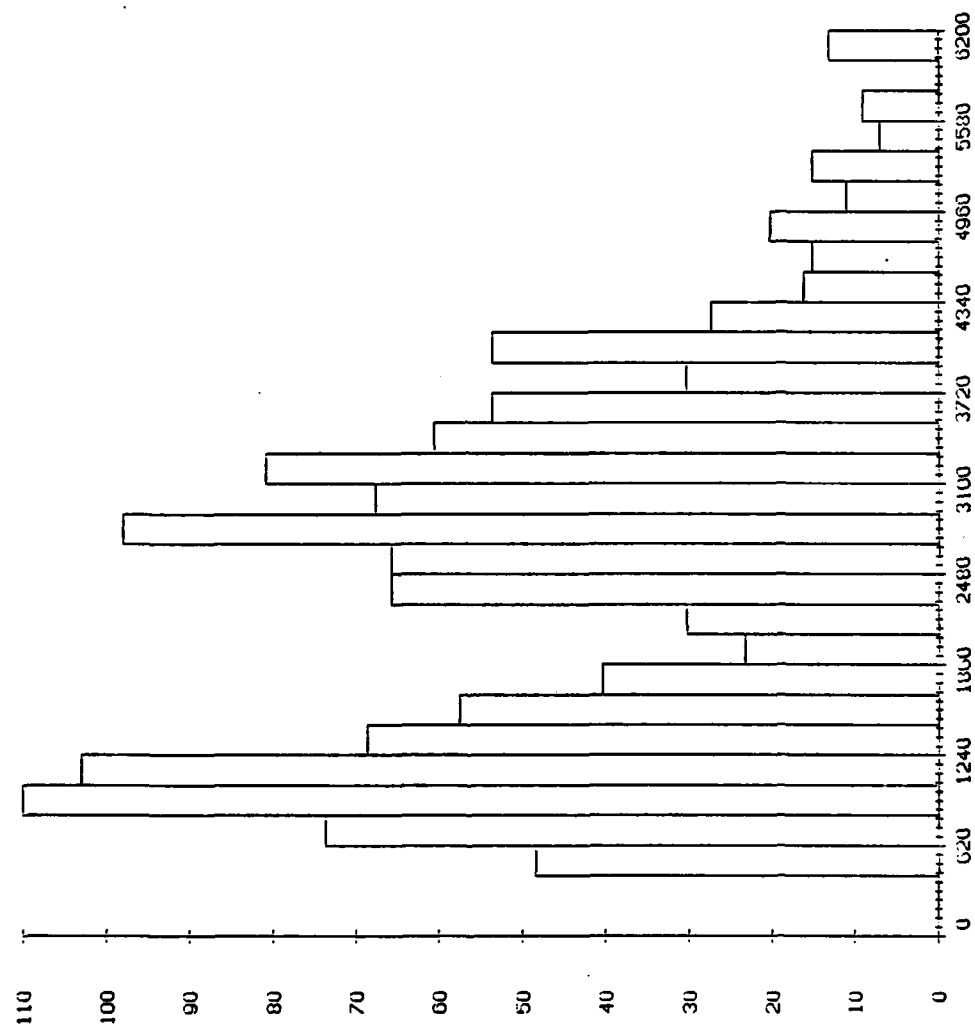
Figure F-11. Time code generator cable (J2)

APPENDIX G
EXAMPLE RESULTS

Once the ground truth on the sensor location and the locations of all targets within the imagery has been established, a variety of statistics can be computed from the operator responses. Typically, the specific analysis and formats for graphical outputs would be provided by the user in a user supplied program. To illustrate the types of data analysis that can be performed, results from one phase of the FOG-M experiment have been included in this appendix. No attempt should be made to draw any conclusions from these specific graphs or computer printouts.

Figures G-1, G-2, and G-3 show the classical number of detections, recognitions, and identifications as a function of range to the target in the histogram format. This type of output is available from a high resolution type of dot matrix printer/plotter. Figure G-4 is a sample computer printout of the different types of data and analysis used in this particular experiment.

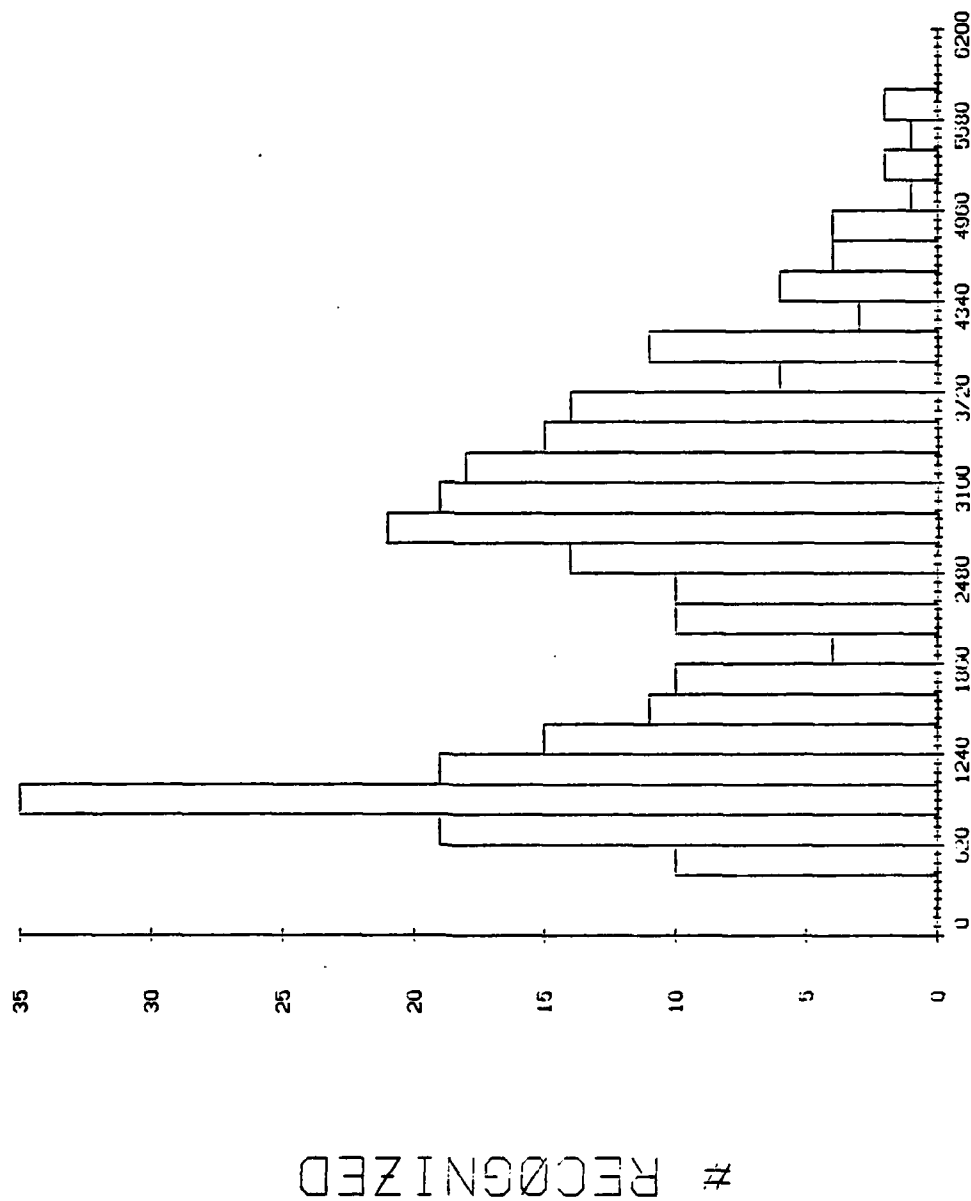
FØGM STATISTICS



RANGE (METERS)

F16
G-1

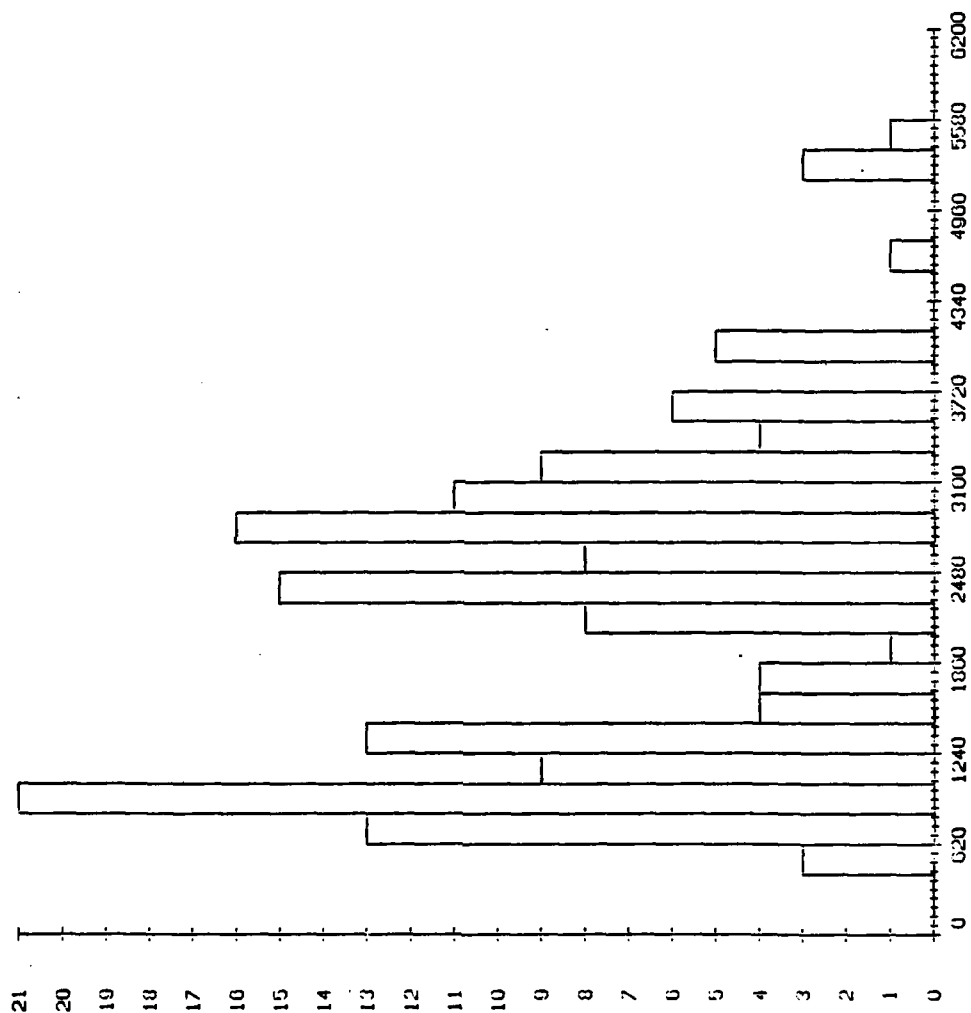
FØGM STATISTICS



RANGE (METERS)

F15
A-2

FØGM STATISTICS



RANGE (METERS)

FIG. 2-2

IDs

```

$RUN AALT
READING GROUND TRUTH DATA FILE GROUND.PFF.. STANDBY.
TOTAL NUMBER OF IRIGS= 11861
READING UNFORMATTED MINI RANGER DATA FROM FILE MINI.DAT
6835 MINI RANGER DATA READ SO LETS GET ON WITH IT.
NUMBER OF CORRECT TANK RECOGNITIONS= 457 WRONG= 41
NUMBER OF CORRECT APC RECOGNITIONS= 66 WRONG= 10
NUMBER OF CORRECT TRUCK RECOGNITIONS= 17 WRONG= 31
NUMBER OF CORRECT JEEP RECOGNITIONS= 14 WRONG= 6

NUMBER OF CORRECT M60 IDENTIFICATIONS= 6 WRONG= 69
NUMBER OF CORRECT M49 IDENTIFICATIONS= 39 WRONG= 80
NUMBER OF CORRECT M551 IDENTIFICATIONS= 89 WRONG= 23
NUMBER OF CORRECT M113 IDENTIFICATIONS= 22 WRONG= 8
NUMBER OF CORRECT LANCE IDENTIFICATIONS= 10 WRONG= 13
NUMBER OF RESETS= 297
NUMBER OF OPERATORS= 26
NUMBER OF TOTAL OPERATOR RESPONSES= 4327
NUMBER OF WRONG TARGET RECOGNITIONS ON ACTUAL TARGETS= 88
NUMBER OF WRONG TARGET IDENTIFICATIONS ON ACTUAL TARGETS= 193
NUMBER OF FALSE TARGET RECOGNITIONS = 261
NUMBER OF FALSE TARGET IDENTIFICATIONS= 92
DESIGNATIONS FOR FALSE TARGET SEQUENCE 4= 69
DESIGNATIONS FOR NO TARGET SEQUENCE 13= 30
DESIGNATIONS FOR NO TARGET SEQUENCE 17= 62
SEQUENCE 1 DESIGNATION COUNT= 293
SEQUENCE 2 DESIGNATION COUNT= 188
SEQUENCE 3 DESIGNATION COUNT= 128
SEQUENCE 4 DESIGNATION COUNT= 0
SEQUENCE 5 DESIGNATION COUNT= 283
SEQUENCE 6 DESIGNATION COUNT= 286
SEQUENCE 7 DESIGNATION COUNT= 290
SEQUENCE 8 DESIGNATION COUNT= 457
SEQUENCE 9 DESIGNATION COUNT= 279
SEQUENCE 10 DESIGNATION COUNT= 400
SEQUENCE 11 DESIGNATION COUNT= 434
SEQUENCE 12 DESIGNATION COUNT= 121
SEQUENCE 13 DESIGNATION COUNT= 0
SEQUENCE 14 DESIGNATION COUNT= 300
SEQUENCE 15 DESIGNATION COUNT= 202
SEQUENCE 16 DESIGNATION COUNT= 0
SEQUENCE 17 DESIGNATION COUNT= 0
SEQUENCE 18 DESIGNATION COUNT= 137
OUTSIDE GROUND TRUTH IRIG= 394
MEAN DETECT TIME= 2.914 SECONDS ON 777 DETECTIONS
WITH A STANDARD DEVIATION OF 2.526
MEAN RECOGNITION TIME= 1.233 SECONDS ON 539 TARGETS
WITH A STANDARD DEVIATION OF 1.727
MEAN IDENTIFICATION TIME= 1.808 SECONDS ON 151 TARGETS
WITH A STANDARD DEVIATION OF 1.921
INCOUNT= 1253 IPILOT= 1
NUMBER OF DETECTIONS AT 325 FEET = 420
NUMBER OF DETECTIONS AT 500 FEET = 275
NUMBER OF DETECTIONS AT 800 FEET = 558
NUMBER OF DETECTIONS OUT OF THE ABOVE ALIS= 0
ERROR ALLOWABLE IN MINIRANGER DATA = 1.500000

INCOUNT= 284 IPILOT= 2
NUMBER OF RECOGNITIONS AT 325 FEET = 102
NUMBER OF RECOGNITIONS AT 500 FEET = 61
NUMBER OF RECOGNITIONS AT 800 FEET = 121

INCOUNT= 155 IPILOT= 3
NUMBER OF IDENTIFICATIONS AT 325 FEET = 62
NUMBER OF IDENTIFICATIONS AT 500 FEET = 28
NUMBER OF IDENTIFICATIONS AT 800 FEET = 65
NUMBER OF IDENTIFICATIONS OUT OF THE ABOVE ALIS=
ERROR ALLOWABLE IN MINIRANGER DATA = 1.500000

```

Figure G-4. Sample computer printout.

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-REI		1
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-RGC		1
-RGN		1
-RD,	Mr. Holder	1
	Mr. Powell	1
-RPT		1
-RPR		15
-LP		1

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