

DOE FILE COPY

DOE/SF/10539-14
(STMPO-564)

HELIOSTAT FIELD CONTROLLER
SOFTWARE SOURCE LISTING

Version A02

Feb 13, 1980

Martin Marietta

1
2
3
4
5
6
7
8
9

*
* HFC FIRMWARE 10MW EPROM VERSION A02 *
*
* AUTHOR: K.A.LENIGER....A00 *
*
* MODIFIED 2/13/80 BY *
* D.A. POWELL....A01 AND LATER *

```
11 *-----*
12 * REVISION HISTORY *
13 *-----*
14 * VERSION A00..30 AUG 79 ...ORIGINAL RELEASE *
15 * VERSION A01..13 FEB 80 ...FOUR WIRE CORR WALK AND *
16 * EXTENDED EMERGENCY CORR *
17 * WALK CAPABILITIES ADDED *
18 * VERSION A02..30 SEP 80 ...MODIFIED TO ENABLE HFC *
19 * TO REMOVE ANY HC WHICH *
20 * REQUESTS INITIALIZATION *
21 * FROM CORRIDOR MASKS *
22 *-----*
```

| | | |
|----|---|--------------------------------------|
| 24 | * | -----* |
| 25 | * | CURRENT HFC SYSTEM MEMORY MAP |
| 26 | * | -----* |
| 27 | * | |
| 28 | * | 0000 - 001F INTERNAL MC6801 I/O REGS |
| 29 | * | 0080 - 00FF INTERNAL RAM |
| 30 | * | 1000 - 13FF EXTERNAL RAM |
| 31 | * | 3000 - 3001 B-BUS ACIA |
| 32 | * | 6000 - 6001 A-BUS ACIA |
| 33 | * | |
| 34 | * | F000 - F7FF ECWOPS |
| 35 | * | F800 - FEFF HFC MAIN |
| 36 | * | FFF0 - FFFF INT. VECTORS |

| Address | Hex | Hex | Label | Width | Value | Description |
|---------|------|------|--------|-------|--------|-----------------------------|
| 38 | | | * | | | ***** |
| 39 | | | * | | | REGISTER MAP |
| 40 | | | * | | | ***** |
| 41 | 0000 | | ORG | | \$0000 | |
| 42 | 0000 | 0001 | P1DD | RMB | 1 | PORT 1 DATA DIRECTION REG |
| 43 | 0001 | 0001 | P2DD | RMB | 1 | PORT 2 DATA DIRECTION REG |
| 44 | 0002 | 0001 | P1DATA | RMB | 1 | PORT 1 DATA |
| 45 | 0003 | 0001 | P2DATA | RMB | 1 | PORT 2 DATA |
| 46 | 0004 | 0001 | P3DD | RMB | 1 | --NOT USED |
| 47 | 0005 | 0001 | P4DD | RMB | 1 | --NOT USED |
| 48 | 0006 | 0001 | P3DATA | RMB | 1 | --NOT USED |
| 49 | 0007 | 0001 | P4DATA | RMB | 1 | --NOT USED |
| 50 | | | * | | | |
| 51 | 0008 | 0001 | TMRCR | RMB | 1 | TIMER CTL/STAT REG |
| 52 | 0009 | 0001 | TMRHI | RMB | 1 | TIMER HI-BYTE |
| 53 | 000A | 0001 | TMRLO | RMB | 1 | TIMER LO-BYTE |
| 54 | 000B | 0001 | TOCHI | RMB | 1 | TMR O/P CMR REG HI-BYTE |
| 55 | 000C | 0001 | TOCLO | RMB | 1 | TMR O/P CMR REG LO-BYTE |
| 56 | 000D | 0001 | TICHI | RMB | 1 | TMR I/P CAPTURE REG HI-BYTE |
| 57 | 000E | 0001 | TICLO | RMB | 1 | TMR I/P CAPT REG LO-BYTE |
| 58 | 000F | 0001 | P3CSR | RMB | 1 | PORT 3 CTL/STAT REG |
| 59 | | | * | | | |
| 60 | 0010 | 0001 | SIORMR | RMB | 1 | SIO RATE/MODE CTL REG |
| 61 | 0011 | 0001 | SIOCSR | RMB | 1 | SIO CTL/STAT REG |
| 62 | 0012 | 0001 | SIORDR | RMB | 1 | SIO RCV DATA REG |
| 63 | 0013 | 0001 | SIOTDR | RMB | 1 | SIO XMT DATA REG |
| 64 | 0014 | 0001 | RAMCR | RMB | 1 | RAM/EPROM CTL REG |
| 65 | | | * | | | |
| 66 | 6000 | | ORG | | \$6000 | HAC ACIA // BUS-A |
| 67 | 6000 | 0002 | AHACSR | RMB | 2 | |
| 68 | 3000 | | ORG | | \$3000 | HAC ACIA // BUS-B |
| 69 | 3000 | 0002 | BHACSR | RMB | 2 | |
| 70 | | | * | | | |
| 71 | | 0000 | CSR | EQU | 0 | CTL/STAT REG |
| 72 | | 0001 | RDR | EQU | 1 | RCV DATA REG |
| 73 | | 0001 | TDR | EQU | 1 | XMT DATA REG |

```

75 -----*
76 *          INTERNAL RAM          *
77 -----*
78 0080      ORG          $0080
79 0080 0001  IOTMR      RMB          1      HIGH SPEED I/O TIMER (833US)
80 0081 0001  DLYTMR     RMB          1      HIGH SPEED DELAY TIMER
81 0082 0001  SUNTMR     RMB          1      LOW SPEED SUN TIMER (53.3MS)
82 *
83 *
84 0083 0002  IOTA       RMB          2      I/O TRANSFER ADDRESS
85 0085 0001  IOTC       RMB          1      I/O TRANSFER COUNT
86 0086 0001  IOCKSM     RMB          1      I/O CHECK-SUM
87 0087 0001  IOWAIT     RMB          1      0= PGM WAIT FOR I/O CMPLT.
88 *          -1= I/O COMPLETE
89 0088 0001  HCIST      RMB          1      SERIAL I/O STATUS == HC INPUT
90 0089 0001  HACIST     RMB          1      ACIA I/O STATUS == HAC INPUT
91 *
92 008A 0001  SPNUM      RMB          1      STATUS POLLING HC#
93 008B 0001  CTR        RMB          1      COUNTER TEMP CELL
94 008C 0001  HACENA     RMB          1      -1=HAC I/O ENABLED, +=NOT
95 008D 0002  FROM       RMB          2      MOVE RTN FROM ADDR
96 008F 0002  TEMP       RMB          2      MOVE RTN TEMP SAVE SP
97 0091 0001  COMASK     RMB          1      A/B SEP COMPL. MASK
98 0092 0001  INZPHZ    RMB          1      INIT PHASE
99 0093 0001  ECWFLG     RMB          1      +=DISABLE ECW
100 0094 0001  ECWPHZ    RMB          1      E.C.W. OPS PHASE
101 0095 0002  ECWTMR    RMB          2
102 0097 0001  CWTYP     RMB          1
103 0098 0001  SPOLBF    RMB          1      STAT POLL O/P BUF
104 *
105          0099  HCIBUF   EQU          *      HC INPUT BUFFER
106 0099 0023  HACIBF     RMB          35     HAC INPUT SHARED WITH HC INPUT BUF
107          00BC  STKLIM   EQU          *
108 00FF      ORG          $00FF
109 00FF 0001  HFCSTK     RMB          1      HFC SYSTEM STACK

```

```

111 -----*
112 *          EXTERNAL RAM          *
113 -----*
114 1000          ORG          $1000
115          1000      HFCRAM      EQU          *
116 1000 0002      PRIBUS      RMB          2          ADDR PRIME BUS
117 1002 0002      ALTBUS      RMB          2          ADDR ALTERNATE
118 *
119 *
120 1004 0009      ACULP       RMB          9          A-CORR. UPPER LIMIT PT.
121 100D 0004          RMB          4          ** MAINTAIN SPACING
122 1011 0009      BCULP       RMB          9          B-CORR. UPPER LIMIT PT.
123 101A 0009      ACLLP       RMB          9          A-CORR. LOWER LIMIT PT.
124 1023 0004          RMB          4          ** MAINTAIN SPACING
125 1027 0009      BCLLP       RMB          9          B-CORR. LOWER LIMIT PT.
126 1030 0009      ADELTA      RMB          9          A-CORR. DELTA X,Y,Z
127 1039 0004      ACWFLG      RMB          4          ** + = CW GOING; ELSE NOT
128 103D 0009      BDELTA      RMB          9          B-CORR. DELTA X,Y,Z
129 1046 0001      BCWFLG      RMB          1          + = CW GOING; ELSE NOT
130 1047 0009      CCULP       RMB          9          C-CORR. UPPER LIMIT PT.
131 1050 0004          RMB          4          ** MAINTAIN SPACING
132 1054 0009      DCULP       RMB          9          D-CORR. UPPER LIMIT PT.
133 105D 0009      CCLLP       RMB          9          C-CORR. LOWER LIMIT PT.
134 1066 0004          RMB          4          ** MAINTAIN SPACING
135 106A 0009      DCLLP       RMB          9          D-CORR. LOWER LIMIT PT.
136 1073 0009      CDELTA      RMB          9          C-CORR. DELTA X,Y,Z
137 107C 0004      CCWFLG      RMB          4          ** + = CW GOING; ELSE NOT
138 1080 0009      DDELTA      RMB          9          D-CORR. DELTA X,Y,Z
139 1089 0001      DCWFLG      RMB          1          + = CW GOING; ELSE NOT

```

```

141 *-----*
142 *                HC COMMAND BUFFER                *
143 *-----*
144 108A 0001  HCMDBF  RMB      1          COMMAND MODE BYTE
145 108B 0003   SX    RMB      3          SUNVEC X-COORD
146 108E 0003   SY    RMB      3          SUNVEC Y-COORD
147 1091 0003   SZ    RMB      3          SUNVEC Z-COORD
148 1094 0004  ACWMSK  RMB      4          C.W. CMD MASK CORRIDOR-A
149 1098 0003  ACWTX  RMB      3          C.W. A      X-COORD
150 109B 0003  ACWTY  RMB      3          C.W. A      Y-COORD
151 109E 0003  ACWTZ  RMB      3          C.W. A      Z-COORD
152 10A1 0004  BCWMSK  RMB      4          C.W. CMD MASK CORRIDOR-B
153 10A5 0003  BCWTX  RMB      3          C.W. B      X-COORD
154 10A8 0003  BCWTY  RMB      3          C.W. B      Y-COORD
155 10AB 0003  BCWTZ  RMB      3          C.W. B      Z-COORD
156 10AE 0004  CCWMSK  RMB      4          C.W. CMD MASK CORRIDOR-C
157 10B2 0003  CCWTX  RMB      3          C.W. C      X-COORD
158 10B5 0003  CCWTY  RMB      3          C.W. C      Y-COORD
159 10B8 0003  CCWTZ  RMB      3          C.W. C      Z-COORD
160 10BB 0004  DCWMSK  RMB      4          C.W. CMD MASK CORRIDOR-D
161 10BF 0003  DCWTX  RMB      3          C.W. D      X-COORD
162 10C2 0003  DCWTY  RMB      3          C.W. D      Y-COORD
163 10C5 0003  DCWTZ  RMB      3          C.W. D      Z-COORD
164 10C8 0004  HCMDSK  RMB      4          BEAM PTNG & AZ/EL PTNG CMD MA
165 10CC 0002  CMDAZ  RMB      2          COMMAND AZIMUTH
166 10CE 0002  CMDEL  RMB      2          COMMAND ELEVATION
167 10D0 0003  BPX    RMB      3          BEAM PTNG X-COORD
168 10D3 0003  BPY    RMB      3          BEAM PTNG Y-COORD
169 10D6 0003  BPZ    RMB      3          BEAM PTNG Z-COORD
170 *                RMB      1          ** CHECK-SUM

```


| Address | Hex | Mask | Field Name | Width | Description |
|---------|------|------|--------------------------------|-------|-----------------------------|
| 172 | | | ***** | | |
| 173 | | | * HFC STATUS RESPONSE BUFFER * | | |
| 174 | | | ***** | | |
| 175 | 10D9 | 0002 | HACSTAT | RMB 2 | ** HAC STATUS OUTPUT BUFFER |
| 176 | 10DB | 0004 | CRMASK | RMB 4 | COMMAND RESPONSE MASK |
| 177 | 10DF | 0002 | | RMB 2 | HC N STATUS WORD |
| 178 | 10E1 | 0002 | | RMB 2 | CURAZ |
| 179 | 10E3 | 0002 | | RMB 2 | CUREL |
| 180 | 10E5 | 0002 | | RMB 2 | HC N+1 STATUS WORD |
| 181 | 10E7 | 0002 | | RMB 2 | CURAZ |
| 182 | 10E9 | 0002 | | RMB 2 | CUREL |
| 183 | 10EB | 0002 | | RMB 2 | HC N+2 STATUS WORD |
| 184 | 10ED | 0002 | | RMB 2 | CURAZ |
| 185 | 10EF | 0002 | | RMB 2 | CUREL |
| 186 | 10F1 | 0002 | | RMB 2 | HC N+3 STATUS WORD |
| 187 | 10F3 | 0002 | | RMB 2 | CURAZ |
| 188 | 10F5 | 0002 | | RMB 2 | CUREL |
| 189 | 10F7 | 0002 | HFSTAT | RMB 2 | HFC STATUS WORD |
| 190 | 10F9 | 0001 | HFCMRTN | RMB 1 | HFC COMMAND RETURN BYTE |
| 191 | | | * | RMB 1 | ** CHECKSUM |
| 192 | 10FA | 0001 | HFMODE | RMB 1 | HFC MODE |
| 193 | 10FB | 0002 | | RMB 2 | ** MAINTAIN SPACING |
| 194 | | | * | | |
| 195 | 10FD | 0004 | UPHCS | RMB 4 | 32 BIT MASK OF UP HC'S |
| 196 | 1101 | 0004 | DNHCS | RMB 4 | 32 BIT MASK OF CLLP HC'S |
| 197 | 1105 | 0004 | WRDNHCS | RMB 4 | 32 BIT MASK OF C.W.DN HC'S |
| 198 | 1109 | 0004 | HCPCS | RMB 4 | 32 BIT MASK OF POSN CMPR'S |
| 199 | 110D | 0004 | BADHCS | RMB 4 | 32 BIT MASK OF BAD HCS |
| 200 | 1111 | 0004 | WRUPHCS | RMB 4 | 32 BIT MASK OF C.W.UP HC'S |
| 201 | | | * | | |
| 202 | 1115 | 0004 | CORAAS | RMB 4 | A CORR ASSIGN MASK |
| 203 | 1119 | 0004 | CORABS | RMB 4 | B CORR ASSIGN MASK |
| 204 | 111D | 0004 | CORACS | RMB 4 | C CORR ASSIGN MASK |
| 205 | 1121 | 0004 | CORADS | RMB 4 | D CORR ASSIGN MASK |
| 206 | | | * | | |
| 207 | 1125 | 0001 | RUSTMTR | RMB 1 | USED IN RESTART BUS SWAP |

209 *-----*
210 * INTERRUPT VECTORS *
211 *-----*
212 *

| | | | | | |
|-----|------|------|-----|--------|--------------------|
| 213 | FFF0 | | ORG | SFFF0 | |
| 214 | FFF0 | F01F | FDB | HCIOI | SERIAL I/O |
| 215 | FFF2 | F017 | FDB | TOF | TIMER OVERFLOW |
| 216 | FFF4 | F000 | FDB | TOC | TIMER O/P CAPT. |
| 217 | FFF6 | F18C | FDB | HFCINZ | ** TIC NOT USED ** |
| 218 | FFF8 | F0B5 | FDB | HACIOI | IRQ FOR ACIA'S |
| 219 | FFFA | F18C | FDB | HFCINZ | |
| 220 | FFFC | F18C | FDB | HFCINZ | |
| 221 | FFFE | F18C | FDB | HFCINZ | RESTART VECTOR |

223 F000

ORG

\$F000

HFC ROM ORIGIN

224

225

* TOC TIMER OUTPUT CAPTURE ROUTINE *

226

227 F000

TOC

EQU

*

228 F000 96 08

LDA A

TMRCSR

CLEAR TOC INT BIT IN CTL/STAT

229 F002 86 04

LDA A

#\$04

230 F004 98 08

ADD A

TOCHI

UPDATE TOC REG BY \$0400

231 F006 97 08

STA A

TOCHI

232 F008 96 80

LDA A

IOTMR

233 F00A 2B 03

BMI

CKDTMR

BRIF NOT

234 F00C 4A

DEC A

235 F00D 97 80

STA A

IOTMR

DECR TIMER CELL

236 F00F 96 81

CKDTMR

LDA A

DLYTMR

CHECK IF TIMER RUNNING

237 F011 2B 03

BMI

XITOC

BRIF NOT

238 F013 4A

DEC A

239 F014 97 81

STA A

DLYTMR

DECR TIMER CELL

240 F016 3B

XITOC

RTI

EXIT INT LVL

241

*

242

243

* TOF TIMER OVERFLOW ROUTINE *

244

245 F017

TOF

EQU

*

246 F017 96 08

LDA A

TMRCSR

CLEAR TOF BIT IN CTL/STAT *

247 F019 96 09

LDA A

TMRHI

REG TO CLEAR INTERRUPT

248 F01B 7A 0082

DEC

SUNTMR

DECR SUN VEC TIMER

249 F01E 3B

RTI

250

*

251

252

* HCOI HC I/O INTERRUPT HANDLER *

253

254 F01F

HCOI

EQU

*

255 F01F DE 83

LDX

IOTA

SET UP X WITH XFRADDR

256 F021 96 11

LDA A

SIOCSR

READ/CLEAR CTL/STAT REG.

257 F023 16

TAB

258 F024 2B 06

BMI

HCIN

BRIF RCV DATA REG FULL

259 F026 48

ASL A

260 F027 48

ASL A

261 F028 2B 20

BMI

HCOU

BRIF XMT DATA REG EMPTY

262 F02A CA 40

ORA B

#\$40

SET ERROR BIT

```

264 *-----*
265 * RECEIVER BUFFER FULL INTERRUPT *
266 *-----*
267 F02C DA 88 HCIN ORA B HCIST
268 F02E D7 88 STA B HCIST SAVE SERIAL I/O STATUS
269 F030 7A 0087 DEC IOWAIT TELL TASK MSG IN PROGRESS
270 F033 96 12 LDA A SIORDR GET BYTE FROM RCV DATA REG
271 F035 D6 85 LDA B IOTC XFR COUNT
272 F037 2B 09 BMI HCINST BRIF TC EXPIRED - DON'T STORE
273 F039 A7 00 STA A 0,X STORE BYTE IN INPUT BUFFER
274 F03B C6 02 LDA B #2 1.66 TO 2.5 MS
275 F03D D7 80 STA B IOTMR TELL USER STILL RCVG MSG
276 F03F 08 INX UPDATE XFRADR
277 F040 DF 83 STX IOTA
278 F042 9B 86 HCINST ADD A IOCKSM ACCUM CHECK-SUM
279 F044 97 86 STA A IOCKSM
280 F046 7A 0085 DEC IOTC UPDATE XFRCNT
281 F049 3B RTI
282 *-----*
283 * TRANSMITTER BUFFER EMPTY INTERRUPT *
284 *-----*
285 F04A HCOUT EQU * HC OUTPUT INTERRUPT
286 F04A D6 85 LDA B IOTC
287 F04C 2B 18 BMI HCODUN BRIF DATA & CKSUM ALREADY O/P
288 F04E 27 0D BEQ HCOCKS BRIF CKSUM NEXT
289 F050 A6 00 LDA A 0,X GET NEXT DATA BYTE 2 GO OUT
290 F052 97 13 STA A SIOTDR OUTPUT TO XMT DATA REG
291 F054 9B 86 ADD A IOCKSM ACCUM CHECK-SUM
292 F056 97 86 STA A IOCKSM
293 F058 08 INX UPDATE XFRADDR
294 F059 DF 83 STX IOTA
295 F05B 20 05 BRA HCOXIT
296 F05D HCOCKS EQU * OUTPUT CHECK-SUM
297 F05D 96 86 LDA A IOCKSM
298 F05F 40 NEG A FORM 2'S COMPL. CHECK-SUM
299 F060 97 13 STA A SIOTDR OUTPUT TO XMT DATA REG
300 F062 5A HCOXIT DEC B UPDATE XFRCNT
301 F063 D7 85 STA B IOTC
302 F065 3B RTI
303 F066 HCODUN EQU * ALL DONE HC OUTPUT
304 F066 86 02 LDA A #2 ALLOW LAST BYTE 2 GET OUT
305 F068 97 80 STA A IOTMR
306 F06A 86 0A LDA A #$0A
307 F06C 97 11 STA A SIOCSR DISABLE INTS
308 F06E 7A 0087 DEC IOWAIT TELL USER TO CONTINUE
309 F071 3B RTI

```

```

311 *-----*
312 *          HC I/O START-UP ROUTINES          *
313 *-----*
314          F072      HCRD      EQU          *          START-UP A READ OF HC
315 F072 0F          SET          PROHIBIT FUNNIES
316 F073 86 20      LDA A      #32      HC INPUT BUFFER SIZE
317 F075 97 85      STA A      IOTC      SET UP MAX INPUT XFR CNT
318 F077 CE 0099    LDX          #HCIBUF
319 F07A 0F 83      STX          IOTA      SET UP XFR ADDR
320 F07C 4F          CLR A
321 F07D 97 86      STA A      IOCKSM     INIT I/O CHECKSUM
322 F07F 97 87      STA A      IOWAIT    TELL USER NO BYTES RCVD YET
323 F081 97 88      STA A      HCIST      CLEAR STATUS ALSO
324 F083 96 02      LDA A      PIDATA
325 F085 8A 80      ORA A      #$80      SET BACK TO RCV MODE
326 F087 97 02      STA A      PIDATA
327 F089 96 11      LDA A      SIOCSR     READ/CLEAR STATUS
328 F08B 96 12      LDA A      SIORDR    READ/CLEAR RCV DATA REG
329 F08D 86 1B      LDA A      #$1B      RCVR, RCV-INT & WAKE-UP
330 F08F 97 11      STA A      SIOCSR     SET MODE OF SIO DEVICE
331 F091 0E          CLI          RE-ENABLE INTS
332 F092 39          RTS
333 *
334          F093      HCWRT     EQU          *          START-UP A WRITE TO HC
335 F093 0F          SET          PROHIBIT FUNNIES
336 F094 97 85      STA A      IOTC      SET-UP XFR CNT
337 F096 DF 83      STX          IOTA      SET-UP XFR ADDRESS
338 F098 4F          CLR A
339 F099 97 86      STA A      IOCKSM     INZ CHECK-SUM
340 F09B 97 87      STA A      IOWAIT
341 F09D 96 02      LDA A      PIDATA
342 F09F 84 7F      AND A      #$7F      ENABLE LINE DRIVER
343 F0A1 97 02      STA A      PIDATA
344 F0A3 96 11      LDA A      SIOCSR     READ/CLEAR STAT REG
345 F0A5 96 12      LDA A      SIORDR    READ/CLEAR RCV DATA REG
346 F0A7 86 0E      LDA A      #$0E      XMT & XMT-INT ON
347 F0A9 97 11      STA A      SIOCSR     SET MODE SERIAL I/O DEVICE
348 F0AB 0E          CLI          1ST INTERRUPT NOW
349 *
350 F0AC 96 87      HCWAT1    LDA A      IOWAIT
351 F0AE 2A FC          BPL          HCWAT1    WAIT TILL I/O DONE
352 F0B0 96 80      HCWAT2    LDA A      IOTMR
353 F0B2 2A FC          BPL          HCWAT2    WAIT TILL LAST BYTE OUT
354 F0B4 39          RTS

```

```

356 *-----*
357 *           HAC I/O ROUTINES *
358 *-----*
359 *           HACIOI   HAC I/O INTERRUPT HANDLER *
360 *-----*
361     F0B5   HACIOI   EQU           *
362 F0B5 FE 1000      LDX           PRIBUS   GET ACIA ADDR
363 F0B8 46 00       LDA A         CSR,X    READ STAT REG
364 F09A 28 05       BMI           HACI     BRIF INTERRUPT
365 F08C FE 1002      LDX           ALTBUS  OFF OTHER ACIA
366 F0BF 20 06       BRA           ACRST
367 F0C1 44         HACI     LSR A
368 F0C2 25 08       BCS           HACIP   BRIF RCVR DATA RDY
369 F0C4 44         LSR A
370 F0C5 25 0A       BCS           HACOP   BRIF XMTR REG EMPTY
371 F0C7 86 53       ACRST    LDA A         #$53
372 F0C9 A7 00       STA A         CSR,X    RESET BAD ACIA
373 F0CB 3B         RTI
374 *
375 F0CC E6 01       HACIP   LDA B         RDR,X    READ DATA BYTE
376 F0CE 8D 16       BSR           HACIN   PROCESS
377 F0D0 3B         RTI
378 *
379 F0D1 D6 85       HACOP   LDA B         IOTC
380 F0D3 28 05       BMI           HACDUN  BRIF LAST INT
381 F0D5 8D 2D       BSR           HACOUT  GET NEXT BYTE
382 F0D7 A7 01       STA A         TDR,X    WRITE TO ACIA
383 F0D9 3B         RTI
384 *
385 F0DA 86 01       HACDUN  LDA A         #1
386 F0DC 97 80       STA A         IOTMR   ALLOW TIME FOR LAST BYTE
387 F0DE 86 12       LDA A         #$12
388 F0E0 A7 00       STA A         CSR,X    OFF INTS / RTS LOW
389 F0E2 7A 0087     DEC           IOWAIT  TELL USER GO
390 F0E5 3B         RTI

```

```

392 -----*
393 *          HAC RECEIVER BUFFER FULL INTERRUPT          *
394 -----*
395     F0E6     HACIN     EQU      *          INPUT PROCESSING
396 F0E6 DE 83     LDY      IOTA     XFR ADDRESS
397 F0E8 9A 89     ORA A    HACIST
398 F0EA 97 89     STA A    HACIST     SET HAC INPUT ACIA STATUS
399 F0EC 7A 0087   DEC      IOWAIT    TELL USER MSG IN PROGRESS
400 F0EF 96 85     LDA A    IOTC
401 F0F1 2B 09     BMI      HAINST    OVERFLOW == DON'T STORE DATA
402 F0F3 E7 00     STA B    0,X      STORE RCVD DATA BYTE
403 F0F5 86 01     LDA A    #1
404 F0F7 97 80     STA A    IOTMR     .8 TO 1.6 MS
405 F0F9 08       INX
406 F0FA DF 83     STX      IOTA     UPDATE XFR ADDRESS
407
408 F0FC DB 86     *          HAINST   ADD B    IOCKSM
409 F0FE D7 86     STA B    IOCKSM    ACCUM CHECK-SUM
410 F100 7A 0085   DEC      IOTC     UPDATE XFR ADDRESS
411 F103 39       RTS
412 -----*
413 *          HAC TRANSMITTER BUFFER EMPTY INTERRUPT        *
414 -----*
415     F104     HACOUT    EQU      *          GET NEXT OUTPUT BYTE
416 F104 3C       PSH X
417 F105 DE 83     LDY      IOTA     XFR ADDRESS
418 F107 5A       DEC B
419 F108 D7 85     STA B    IOTC     UPDATE XFR COUNT
420 F10A 2B 0C     BMI      HACKSM   BRIF OUTPUT CHECKSUM
421 F10C A6 00     LDA A    0,X      GET NEXT BYTE 2 GO OUT
422 F10E 16       TAB
423 F10F DB 86     ADD B    IOCKSM
424 F111 D7 86     STA B    IOCKSM    ACCUM CHECK-SUM
425 F113 08       INX
426 F114 DF 83     STX      IOTA     UPDATE XFR ADDRESS
427 F116 38       PUL X
428 F117 39       RTS
429
430     F118     HACKSM    EQU      *          OUTPUT CHECKSUM
431 F118 96 86     LDA A    IOCKSM
432 F11A 40       NEG A
433 F11B 38       PUL X
434 F11C 39       RTS

```

```

436 -----*
437 *
438 -----*
439          F11D      HACWRT  EQU          *          START OUTPUT TO HAC
440 F11D 8D 63        BSR          WATONE        WAIT .8 TO 1.6 MS.
441 F11F 0F          SEI          PROHIBIT FUNNIES
442 F120 97 85        STA A      IOTC          XFR COUNT FROM USER
443 F122 DF 83        STX          IOTA          XFR ADDR FROM USER
444 F124 4F          CLR A
445 F125 97 86        STA A      IOCKSM        INZ CHECKSUM
446 F127 97 87        STA A      IOWAIT
447 F129 FE 1000     LDX          PRIBUS
448 F12C 86 53        LDA A      #$53
449 F12E A7 00        STA A      CSR,X        MASTER CLEAR ACIA
450 F130 86 32        LDA A      #$32        XMT INT & RTS ENABLE
451 F132 A7 00        STA A      CSR,X
452 F134 0E          CLI          1ST INT NOW
453
454 F135 96 87        *          HACWT1  LDA A      IOWAIT
455 F137 2A FC        BPL          HACWT1  WAIT TILL DONE
456 F139 96 80        HACWT2  LDA A      IOTMR
457 F13B 2A FC        BPL          HACWT2  DELAY TILL LAST BYTE OUT
458 F13D 86 52        LDA A      #$52        RTS HI & INTS OFF
459 F13F A7 00        STA A      CSR,X
460 F141 39          RTS
461
462 F142 0F          *          HACRD   SEI          PROHIBIT FUNNIES
463 F143 86 22        LDA A      #34
464 F145 97 85        STA A      IOTC          SET-UP MAX XFR SIZE
465 F147 CE 0099     LDX          #HACIBF
466 F14A DF 83        STX          IOTA          SET-UP XFR ADDRESS
467 F14C 4F          CLR A
468 F14D 97 86        STA A      IOCKSM        INIT I/O CHECKSUM
469 F14F 97 87        STA A      IOWAIT        TELL USER NO BYTES RCVD YET
470 F151 97 89        STA A      HACIST        CLEAR HAC ACIA STATUS
471 F153 FE 1000     LDX          PRIBUS
472 F156 86 53        LDA A      #$53
473 F158 A7 00        STA A      CSR,X        MASTER CLEAR ACIA
474 F15A 86 D2        LDA A      #$D2
475 F15C A7 00        STA A      CSR,X        RCV INT ENABLE
476 F15E 0E          CLI
477 F15F 39          RTS

```



```

479 *-----*
480 *           HAC I/O BUS SWAP SUBROUTINE           *
481 *-----*
482          F160      BUSWAP      EQU          *
483 F160 0F          SEI
484 F161 86 53      LDA A          #$53
485 F163 FE 1002    LDX          ALTBUS      GET OLD ALT BUS
486 F166 3C          PSH X          SAVE IT AWAY
487 F167 FE 1000    LDX          PRIBUS      GET PRIMARY
488 F16A FF 1002    STX          ALTBUS      PRI NOW ALT
489 F16D A7 00      STA A          CSR,X      MASTER CLEAR IT
490 F16F 38          PUL X          GET BACK PRIMARY
491 F170 FF 1000    STX          PRIBUS      ALT NOW PRI
492 F173 A7 00      STA A          CSR,X      MASTER CLEAR IT
493 F175 8C 3000    CPX          #$3000     IS ACIA 2 NOW PRIMARY?
494 F178 27 04      BEQ          BUSW2      YES..RESET SELECT BIT
495 F17A 86 0D      LDA A          #$0D          ENABLE A BUS
496 F17C 20 02      BRA          BUSW1
497 F17E 86 0C      BUSW2      LDA A          #$0C          ENABLE B BUS
498 F180 97 08      BUSW1      STA A          TMRCSR
499 *
500 F182 C6 01      WATONE     LDA B          #$01          ALSO USED BY 'HACWRT'
501 F184 D7 81      STA B          DLYTMR      SET DELAY TILL THE SELECT
502 F186 0E          CLI          BIT (OLVL:P21) IS CLK'D OUT
503 F187 D6 81      WATBUS     LDA B          DLYTMR
504 F189 2A FC      BPL          WATBUS      WAIT FOR SELECT
505 F18B 39          RTS

```

```

507 *-----*
508 *           HFC INITIALIZATION ROUTINE           *
509 *-----*
510          F18C   HFCINZ   EQU           *
511 F18C 8E 10FF          LDS           #HFCRAM+SFF
512 F18F 4F              CLR A           POINT TO 256 BYTES
513 F190 5F              CLR B           PAST BUFF START
514 F191 36              INZ00          PSH A           CLEAR LOCATION
515 F192 5C              INC B           COUNT UP BY 1
516 F193 26 FC          BNE           INZ00          HAS B ROLLED OVER YET?
517 *
518 F195 86 53          LDA A           #553          MASTER RESET
519 F197 5F              CLR B
520 F198 87 6000        STA A           AHACSR          ACIA 1 AND
521 F198 87 3000        STA A           BHACSR          ACIA 2
522 F19E 86 60          LDA A           #560          SELECT ACIA 1 AS THE
523 F1A0 FD 1000        STD           PRIBUS          PRIMARY ONE
524 F1A3 47              ASR A           SELECT ACIA 2 AS THE
525 F1A4 FD 1002        STD           ALTBUS          SECONDARY ONE
526 *
527 F1A7 86 C0          LDA A           #5C0          SET UP I/O CONFIG
528 F1A9 97 00          STA A           P1DD           FOR PORT 1
529 F1AB 97 02          STA A           P1DATA          SET OUTS HIGH
530 F1AD 86 17          LDA A           #517          SET UP I/O CONFIG
531 F1AF 97 01          STA A           P2DD           FOR PORT 2
532 *
533 F1B1 86 04          LDA A           #504          SET UP COMPARE VALUE
534 F1B3 97 08          STA A           TOCHI           TO $0400
535 F1B5 4C              INC A           SET UP RATE AND MODE
536 F1B6 97 10          STA A           SIORMR          OF SERIAL I/O PORT
537 F1B8 86 0D          LDA A           #50D          SET UP CONFIG OF
538 F1BA 97 08          STA A           TMRCR          TIMER
539 F1BC 86 0A          LDA A           #50A          SET UP CONFIG OF
540 F1BE 97 11          STA A           SIOCSR          SERIAL I/O
541 F1C0 87 1125        STA A           BUSTMR          SET 12 SECOND BUS TIME
542 *
543 F1C3 86 80          LDA A           #580          SET RESET MODE....
544 F1C5 87 10F7        STA A           HFSTAT          ...FOR HFC
545 F1C8 87 10F9        STA A           HFCMRTN
546 F1C8 86 12          LDA A           #512          SET UP SUN TIMER
547 F1CD 97 82          STA A           SUNTMR
548 F1CF 86 FF          LDA A           #5FF
549 F1D1 97 8C          STA A           HACENA          ENABLE HAC INPUT
550 F1D3 86 7F          LDA A           #57F          SET UP DUMMY CMD
551 F1D5 87 108A        STA A           HCMDBF          FOR HC
552 F1D8 4F              CLR A
553 F1D9 5F              CLR B
554 F1DA FD 110D        STD           BADHCS
555 F1DD FD 110F        STD           BADHCS+2
556 *

```

C00 13:24 JAN 27, '84
557 F1E0 8E 00FF
558 F1E3 0E

MMC M6801/M6803 MPU ASSEMBLER
LDS #HFCSTK SET STACK POINTER
CLI

PAGE 18

```

560 -----*
561 *          CMDI          HAC COMMAND INTERPRETER          *
562 -----*
563 *
564 F1E4 7F 0087 CMDI      CLR          IOWAIT          IN CASE NO HACRD
565 F1E7 7D 008C          TST          HACENA
566 F1EA 2A 03          BPL          IDLE          BRIF HAC NOT ENABLED
567 F1EC 8D F142          JSR          HACRD          START UP A READ FROM HAC
568          F1EF          IDLE      EQU          *          IDLE HERE TILL HACIN OR SVTMOI
569 F1EF 96 87          LDA A          IOWAIT
570 F1F1 2A 04          BPL          CKSVTM          BRIF NO BYTES RCV'D YET
571 F1F3 96 80          LDA A          IOTMR
572 F1F5 2B 1C          BMI          CMDIN          BRIF LAST BYTE TIMED OUT
573 F1F7 96 82          CKSVTM      LDA A          SUNTMR
574 F1F9 2A F4          BPL          IDLE          SUN-VEC NOT TIMED OUT
575 F1FB FE 1000          LDX          PRIBUS          PRIME ACIA ADDR
576 F1FE 86 52          LDA A          #552
577 F200 A7 00          STA A          CSR,X          OFF INTS
578 F202 86 12          LDA A          #18
579 F204 97 82          STA A          SUNTMR          RESET SV TIMER FOR 1.013333 SE
580 F206 86 80          LDA A          #80
581 F208 97 02          STA A          PIDATA          CLEAR WATCHDOG TIMER
582 F20A 47          ASR A
583 F20B 97 02          STA A          PIDATA          RE-ENABLE W.D. TIMER
584 F20D F6 10FA          LDA B          HFMODE
585 F210 5C          INC B          SET UP PROCEEDURE INDEX
586 F211 20 1C          BRA          REENTR
587 -----*
588 *          PROCESS HAC COMMAND          *
589 -----*
590 *
591          F213          CMDIN      EQU          *
592 F213 FE 1000          LDX          PRIBUS          ADDR PRIME ACIA
593 F216 86 52          LDA A          #552
594 F218 A7 00          STA A          CSR,X          OFF INTS
595 F21A 96 89          LDA A          HACIST          HAC ACIA INPUT STATUS
596 F21C 84 38          AND A          #538
597 F21E 26 3C          BNE          IOERR          BRIF OR/FE/PE
598 F220 8D F2AE          JSR          VALCMD          CHECK TYPE,LENGTH,HFC#,CKSUM
599 F223 5D          TST B          RESULTS IN 9 REG
600 F224 2B 36          BMI          IOERR          BRIF BAD MESSAGE
601 F226 27 02          BEQ          *+4          BRIF GOOD MESSAGE FOR ME
602 F228 20 BA          BRA          CMDI          ELSE; MSG IS NOT FOR ME
603 F22A F6 10FA          LDA B          HFMODE
604 F22D CB 04          ADD B          #4          SET UP PROCEEDURE INDEX

```

606
607
608
609

* MODE/INPUT BRANCH TABLE *

| 610 | F22F | REENTR | EQU | * | PROCX / | MODE / | REASON |
|-----|--------------|---------|-------|---------|---------|-----------|----------------------------|
| 611 | F22F 5D | | TST B | | ----- | ----- | ----- |
| 612 | F230 27 8D | | BEQ | IDLE | 0 / | IDLE / | |
| 613 | F232 5A | | DEC B | | | | |
| 614 | F233 27 3A | | BEQ | RSTSTO | 1 / | RESTART / | SVEC TIMEOUT |
| 615 | F235 5A | | DEC B | | | | |
| 616 | F236 27 4E | | BEQ | NRMSTO | 2 / | NORMAL / | SVEC TIMEOUT |
| 617 | F238 5A | | DEC B | | | | |
| 618 | F239 27 58 | | BEQ | ECWSTO | 3 / | E.C.W. / | SVEC TIMEOUT |
| 619 | F23B 5A | | DEC B | | | | |
| 620 | F23C 27 5B | | BEQ | RSTHI | 4 / | RESTART / | HAC INPUT |
| 621 | F23E 5A | | DEC B | | | | |
| 622 | F23F 26 03 | | BNE | REENTR1 | | | |
| 623 | F241 7E F2FC | | JMP | NRMHI | 5 / | NORMAL / | HAC INPUT |
| 624 | F244 5A | REENTR1 | DEC B | | | | |
| 625 | F245 27 52 | | BEQ | ECWHI | 6 / | E.C.W. / | HAC INPUT |
| 626 | F247 5A | | DEC B | | | | |
| 627 | F248 26 03 | | BNE | REENTR2 | | | |
| 628 | F24A 7E F603 | | JMP | HCOPS | 7 / | / | HC OPERATIONS TA |
| 629 | F24D 5A | REENTR2 | DEC B | | | | |
| 630 | F24E 26 03 | | BNE | REENTR3 | | | |
| 631 | F250 7E F7B5 | | JMP | CWALC | 8 / | / | C.W. CALCULATION |
| 632 | F253 5A | REENTR3 | DEC B | | | | |
| 633 | F254 26 03 | | BNE | CMDERR | | | |
| 634 | F256 7E F8F4 | | JMP | ECWOPS | 9 / | / | E.C.W. OPERATION |
| 635 | | * | | | | | |
| 636 | F259 7E 10F9 | CMDERR | CLR | HFCMRTN | | | SET INVALID CMD RETURN |
| 637 | F25C 86 40 | IOERR | LDA A | #S40 | | | SET COMM. ERROR BIT |
| 638 | F25E 8A 10F7 | | ORA A | HFSTAT | | | |
| 639 | F261 87 10F7 | | STA A | HFSTAT | | | SET HFC STATUS WORD |
| 640 | F264 7E F1E4 | JCMDI | JMP | CMDI | | | GO START NEW HAC READ |
| 641 | F267 4D | CMDIRTN | TST A | | | | |
| 642 | F268 2B C5 | | BMI | REENTR | | | BRIF MORE PROCESSING REQ'D |
| 643 | F26A 27 FB | | BEQ | JCMDI | | | BRIF NEW HAC READ REQ'D |
| 644 | F26C 7E F1EF | | JMP | IDLE | | | |

```

646 *****
647 *          PROCESS SVEC TIMEOUT IN RESTART MODE          *
648 *****
649 F26F RSTSTO EQU *
650 F26F 7A 1125 DEC BUSTMR COUNTDOWN BUS SWAP TIMER
651 F272 26 08 BNE RSTSTS IF NOT ZERO, CONTINUE
652 F274 8D F160 JSR BUSWAP IF TIME SWAP BUSES
653 F277 86 0C LDA A #12 SET UP 12 SECONDS
654 F279 87 1125 STA A BUSTMR AND WAIT TO SWAP BUS
655 F27C 86 80 RSTSTS LDA A #S80
656 F27E 87 10F7 STA A HFSTAT RESET INZPHZ IN HFC STAT
657 F281 4F CLR A
658 F282 97 92 STA A INZPHZ RESET INZPHZ
659 F284 20 E1 BRA CMDIRTN A-REG=0; START HAC READ
660 *****
661 *          PROCESS SVEC TIMEOUT IN NORMAL MODE          *
662 *****
663 F286 NRMSTO EQU *
664 F286 7A 0093 DEC ECWFLG COUNT 3 MISSED I/O'S
665 F289 2A 08 BPL DOHCOP BRIF NOT 3 YET
666 F28B C6 02 LDA B #2
667 F28D F7 10FA STA B HFMODE SET E.C.W. MODE
668 F290 8D F160 JSR BUSWAP TRY BUS=B
669 *****
670 *          PROCESS SVEC TIMEOUT IN E.C.W. MODE          *
671 *****
672 F293 ECWSTO EQU *
673 F293 86 FF DOHCOP LDA A #-1 REENTR CODE
674 F295 C6 07 LDA B #7 PERFORM HCOPS TASK
675 F297 20 CE BRA CMDIRTN
676 *****
677 *          PROCESS HAC INPUT IN RESTART MODE          *
678 *          OR IN E.C.W. MODE          *
679 *****
680 F299 RSTHI EQU *
681 F299 ECWHI EQU *
682 F299 96 99 LDA A HACIBF GET MSG TYPE CODE
683 F29B 81 80 CMP A #S80
684 F29D 26 0C BNE NOSUN BRIF NOT SUN/SYNC MESSAGE
685 F29F 87 10F9 STA A HFCMRTN SET HFC COMMAND RETURN
686 F2A2 86 0A LDA A #10 COUNT 10 MISSED SUNS
687 F2A4 97 93 STA A ECWFLG DISABLE ECWOPS TASK
688 F2A6 86 01 LDA A #1
689 F2A8 87 10FA STA A HFMODE SET NOW NORMAL MODE
690 F2AB 4F NOSUN CLR A SET NEW HAC READ REQ'D CODE
691 F2AC 20 B9 BRA CMDIRTN

```

```

693 -----*
694 *          VALIDATE COMMAND FOR HFC#, GOOD CHECKSUM, *
695 *          AND CORRECT LENGTH. RESULT RETURN IN RB. *
696 -----*
697          F2AE  VALCMD  EQU          *
698 F2AE 5F          CLR B          INZ TO MSG GOOD
699 F2AF 96 99      LDA A          GET MSG FIRST BYTE
700 F2B1 2A 06     BPL          BRIF HFC# IN SECOND BYTE
701 F2B3 84 7F     AND A          #87F      $80 IS SUN
702 F2B5 27 11     BEQ          WDTRST    BRIF SUN == RESET W.D. TMR
703 F2B7 20 07     BRA          CKHFN     HFC# READY FOR CHECKING
704 F2B9 96 9A     GET2ND  LDA A          HACIBF+1  GET 2ND BYTE
705 F2BB 44          LSR A
706 F2BC 44          LSR A
707 F2BD 44          LSR A          HFC# FROM BITS 7-5 TO 2-0
708 F2BE 44          LSR A
709 F2BF 44          LSR A
710 F2C0 98 02     CKHFN  EOR A          PIDATA    COMPARE W/ DIP SWITCH SETTING
711 F2C2 84 07     AND A          #7
712 F2C4 27 0D     BEQ          CKCKSM    BRIF THIS HFC
713 F2C6 5C          INC B
714 F2C7 39          RTS          RETURN SINCE NOT THIS HFC
715 *
716 F2C8 86 16     WDTRST  LDA A          #22      1.23 SECS.
717 F2CA 97 82     STA A          SUNTMR    RESET SUNVEC TIMER
718 F2CC 86 80     LDA A          #80
719 F2CE 97 02     STA A          PIDATA    CLEAR W.D.TIMER
720 F2D0 47          ASR A
721 F2D1 97 02     STA A          PIDATA    RE-ENABLE W.D.TIMER

```

723

724

* VALIDATE CHECKSUM AND MESSAGE LENGTH *

725

726 F2D3 96 86 CKCKSM LDA A IOCKSM GET ACCUMULATED CHECK-SUM

727 F2D5 27 01 BEQ **3 BRIF OK

728 F2D7 5A DEC B SET NEG IF BAD

729 F2D8 37 PSH B

730 F2D9 06 99 LDA B HACIBF MSG TYPE FROM 1ST BYTE

731 F2DB 54 LSR B

732 F2DC 54 LSR B

733 F2DD 54 LSR B MOVE TO BITS 3-0

734 F2DE 54 LSR B

735 F2DF CE F2EC LDX #LENTAB

736 F2E2 3A ABX MAKE INDEX INTO LENGTH TABLE

737 F2E3 33 PUL B

738 F2E4 A6 00 LDA A 0,X GET MSG LENGTH

739 F2E6 91 85 CMP A IOTC

740 F2E8 27 01 BEQ **3 BRIF I/O XFR COUNT RIGHT

741 F2EA 5A DEC B

742 F2EB 39 RTS

743

*
* MSG LENGTH: TYPE--0--1--2--3--4--5--6--7

744
745 F2EC 0E LENTAB FCB 14,14,14,14,30,0,30,24

F2ED 0E

F2EE 0E

F2EF 0E

F2F0 1E

F2F1 00

F2F2 1F

F2F3 18

746 * MSG LENGTH: TYPE--8--9--A--B--C--D--E--F

747 F2F4 12 FCB 18,14,14,14,14,14,14,14

F2F5 0E

F2F6 0E

F2F7 0E

F2F8 0E

F2F9 0E

F2FA 0E

F2FB 0E


```

749 *-----*
750 *          NORMAL MODE HAC COMMAND PROCESSING          *
751 *-----*
752 *
753 F2FC      NRMHI      EQU      *          PROCESS HAC INPUT IN NRML MODE
754 F2FC D6 99          LDA B      HACIBF
755 F2FE 2A 1B          BPL          NOTSUN      BRIF NOT SUN OR HFC INIT PKT
756 F300 C1 90          CMP B      #$90
757 F302 2D 08          BLT          NOTINZ      BRIF NOT INZ CMD
758 F304 F7 10F9       STA B      HFCMRTN      SET HFC CMD RTN FOR HAC
759 F307 8D F52F       JSR          CMDINI      PROCESS INIT PACKET
760 F30A 20 32          BRA          JCRTN      RETURN TO CMDI
761 F30C C1 80          NOTINZ     CMP B      #$80      80 IS SUN CMD
762 F30E 27 03          BEQ          YESSUN      BRIF SUN PACKET
763 F310 7E F259       JMP          CMDERR      ELSE BAD COMMAND
764 F313 8D 2D          YESSUN     BSR          XFRSUN      MOVE SUN INFO TO HC CMD PKT
765 F315 C6 07          LDA B      #7          CODE TO RUN HCOPS
766 F317 86 FF          LDA A      #-1         CODE TO REENTER
767 F319 20 24          BRA          JCRTN+1     REENTER CMDI
768 F31B C1 40          NOTSUN     CMP B      #$40         40-7F ARE STATUS PACKETS
769 F31D 2D 10          BLT          NOTSTAT     BRIF NOT STAT REQ OR RESPONSE
770 F31F 26 05          BNE          NOTST4      BRIF NOT STAT=4 REQUEST
771 F321 8D F362       JSR          CMDS4       PROCESS STAT=4 REQ.
772 F324 20 18          BRA          JCRTN      RETURN TO CMDI
773 F326 C1 60          NOTST4     CMP B      #$60
774 F328 26 14          BNE          JCRTN      RET TO CMDI IF NOT STAT=1 REQ
775 F32A 8D F378       JSR          CMDS1       PROCESS STAT=1 REQ
776 F32D 20 0F          BRA          JCRTN      RETURN TO CMDI
777          F32F       NOTSTAT     EQU          *          MUST BE HC COMMAND PKT
778 F32F 96 92          LDA A      INZPHZ      INITIALIZATION PHASE
779 F331 81 06          CMP A      #$6
780 F333 27 03          BEQ          OKCMD      BRIF CAN ACCEPT COMMAND
781 F335 7E F259       JMP          CMDERR      TELL HAC HE GOOFED
782 F338 F7 10F9       OKCMD     STA B      HFCMRTN      SET CMD RETURN FOR HAC
783 F33B 8D F39A       JSR          CMDCMD     PROCESS COMMAND
784 F33E 4F          JCRTN     CLR A          SET RTN CODE 'NEED HAC READ'
785 F33F 7E F267       JMP          CMDIRTN

```

```
787 *****
788 * TRANSFER SUN VECTOR INTO INPUT BUFFER *
789 *****
790 F342 XFRSUN EQU *
791 F342 CE 108B LDX #SX DEST. ADDRESS
792 F345 DC 9B LDD HACIBF+2
793 F347 ED 00 STD 0,X X=COORD MS 2 BYTES
794 F349 96 9D LDA A HACIBF+4
795 F34B A7 02 STA A 2,X X=COORD LS BYTE
796 F34D DC 9F LDD HACIBF+6
797 F34F ED 03 STD 3,X Y=COORD MS 2 BYTES
798 F351 96 A1 LDA A HACIBF+8
799 F353 A7 05 STA A 5,X Y=COORD LS BYTE
800 F355 DC A3 LDD HACIBF+10
801 F357 ED 06 STD 6,X Z=COORD MS 2 BYTES
802 F359 96 A5 LDA A HACIBF+12
803 F35B A7 08 STA A 8,X Z=COORD LS BYTE
804 F35D 96 9A LDA A HACIBF+1
805 F35F 97 8A STA A SPNUM STAT POLL HC#
806 F361 39 RTS
```

```

808 *-----*
809 *          CMDS4          PROCESS STATUS REQUEST FROM HAC *
810 *-----*
811 *
812      F362      CMDS4      EQU          *
813 F362 CE 10D9      LDX          #HACSTAT      HAC STATUS O/P BUFFER
814 F365 86 21      LDA A          #33          I/O #BYTES
815 F367 BD F11D      JSR          HACWRT      WRITE STATUS BUFFER TO HAC
816 F36A 86 80      LDA A          #80
817 F36C B7 10F9      STA A          HFCMRTN      RESET AFTER STATUS
818 F36F B6 10F7      LDA A          HFSTAT
819 F372 84 B0      AND A          #80          RESET I/O & CMD ERR BITS
820 F374 B7 10F7      STA A          HFSTAT
821 F377 39          RTS
822 *-----*
823 *          CMDS1          PROCESS SPECIAL SINGLE HC STATUS *
824 *-----*
825 *
826      F378      CMDS1      EQU          *
827 F378 96 9A      LDA A          HACIBF+1      GET REQUSET HC#
828 F37A 84 1F      AND A          #81F
829 F37C 97 8A      STA A          SPNUM
830 F37E 5F      CLR B
831 F37F 96 02      LDA A          PIDATA          GET HFC#
832 F381 04      LSR D
833 F382 04      LSR D
834 F383 04      LSR D
835 F384 DB 8A      ADD B          SPNUM
836 F386 86 70      LDA A          #870          FORM & STORE HDR BYTE
837 F388 FD 10D9      STD          HACSTAT
838 F38B CE 10DB      LDX          #HACSTAT+2      WHERE TO STORE STATUS
839 F38E BD F71A      JSR          POL1HC          POLL HC & MOVE DATA
840 F391 CE 10D9      LDX          #HACSTAT      I/O ADDRESS
841 F394 86 09      LDA A          #9          #BYTES
842 F396 BD F11D      JSR          HACWRT          O/P STATUS MSG TO HAC
843 *          *          & WAIT FOR I/O CMPLTN
844 F399 39          RTS

```

```

846 *-----*
847 *          CMDCMD      PROCESS HC COMMANDS          *
848 *-----*
849 *
850 F39A CE 0099 CMDCMD  LDX      #HACIBF
851 F39D EC 00          LDD      0,X          GET HEADER & HC#
852 F39F 08           INX
853 F3A0 0F 8D          STX      FROM          SET UP MOVE FROM ADDRESS
854 F3A2 81 18          CMP A   #S18          18,19,1A,1B MODES
855 F3A4 2C 40          BGE     CMDAE          AZ/EL COMMANDS
856 F3A6 81 10          CMP A   #S10          10 THRU 17 MODES
857 F3A8 2D 03          BLT     CMDCMD1        CORR. WALK START
858 F3AA 7E F45F        JMP     CMDCW
859 F3AD 81 08          CMDCMD1 CMP A   #S08          8,9,A,B,C,D MODES
860 F3AF 2C 16          BGE     CMDBP          BEAM POINTING COMMAND
861 *-----*
862 *          PROCESS HC INITIALIZATION DATA          *
863 *-----*
864 F3B1 C4 1F          CMDHCIN AND B   #S1F          HC INIT COMMAND
865 F3B3 F7 108A        STA B   HCMDBF          SET HC# + HDR CODE
866 F3B6 08           INX
867 F3B7 8D 65          BSR     KILLSB          KILL 2 LSB'S CURAZ/CUREL
868 F3B9 8D 63          BSR     KILLSB          KILL 2 LSB'S BIAS AZ/EL
869 F3BB CE 10C8        LDX     #HCMDSK          MOVE TO ADDRESS
870 F3BE C6 EF          LDA B   #-17           MOVE 17 BYTES
871 F3C0 8D F51B        JSR     MOVE
872 F3C3 8D F42E        JSR     STXT           REMOVE HC FROM CW MASKS
873 F3C6 39           RTS
874 *-----*
875 *          PROCESS HC BEAM POINTING DATA          *
876 *-----*
877          F3C7          CMDBP  EQU      *          PROCESS BEAM PTNG CMD
878 F3C7 C6 04          LDA B   #4
879 F3C9 3A           ABX
880 F3CA DF 8D          CMDBP2 STX      FROM          MOVE FROM BEAM COORDS
881 F3CC 8A 20          ORA A   #S20
882 F3CE B7 108A        STA A   HCMDBF          SET HEADER BYTE FOR HC
883 F3D1 DC 9B          LDD     HACIBF+2
884 F3D3 FD 10C8        STD     HCMDSK          SET 32-BIT COMMAND MASK
885 F3D6 DC 9D          LDD     HACIBF+4
886 F3D8 FD 10CA        STD     HCMDSK+2
887 F3DB 8D 1E          BSR     XTRACT          REMOVE BP HC'S FROM CW MASKS
888 F3DD CE 10D0        LDX     #BPX           MOVE COORDS TO HC CMD BUF
889 F3E0 C6 F7          LDA B   #-9           MOVE 9 BYTES
890 F3E2 8D F51B        JSR     MOVE
891 F3E5 39           RTS
892 *-----*
893 *          PROCESS HC AZ/EL POSITION DATA          *
894 *-----*
895          F3E6          CMDAE  EQU      *          PROCESS AZ/EL HC COMMAND

```

```

896 F3E6 8A 70      ORA A      #870
897 F3E8 B7 108A    STA A      HCMDBF      SET HEADER CODE FOR HC
898 F3EB C6 05      LDA B      #5
899 F3ED 3A          ABX
900 F3EE 8D 2E      BSR          KILLSB      KILL 2 LSB'S CMDAZ/EL
901 F3F0 CE 10C8    LDX          #HCMDMSK    MOVE TO ADDRESS
902 F3F3 C6 F8      LDA B      #-8          MOVE 8 BYTES
903 F3F5 BD F51B    JSR          MOVE        MOVE MASK & AZ/EL
904 F3F8 BD 01      BSR          XTRACT      REMOVE AE HC'S FROM CW MASKS
905 F3FA 39          RTS

```

```

906
907      *-----*
908      *          REMOVE COMMANDED HCS FROM CW MASKS          *
909      *-----*

```

```

909      F3FB      XTRACT      EQU          *          EXTRACT HC'S FROM CW MASKS
910 F3FB CE 108A    LDX          #HCMDBF
911 F3FE C6 FC      LDA B      #-4          DO FOR 4 BYTE MASKS
912 F400 A6 3E      XTRLP      LDA A      $3E,X      BEAM OR AZ/EL CMD MASK
913 F402 43          COM A
914 F403 36          PSH A          TEMP SAVE CAUSE 2 CW MASKS
915 F404 A4 0A      AND A      10,X
916 F406 A7 0A      STA A      10,X          EXTRACT FROM CW-A MASK
917 F408 32          PUL A
918 F409 36          PSH A
919 F40A A4 17      AND A      23,X
920 F40C A7 17      STA A      23,X          EXTRACT FROM CW-B MASK
921 F40E 32          PUL A
922 F40F 36          PSH A
923 F410 A4 24      AND A      36,X
924 F412 A7 24      STA A      36,X          EXTRACT FROM CW-C MASK
925 F414 32          PUL A
926 F415 A4 31      AND A      49,X
927 F417 A7 31      STA A      49,X          EXTRACT FROM CW-D MASK
928 F419 08          INX
929 F41A 5C          INC B
930 F41R 2B E3      BMI          XTRLP      DO FOR 4-BYTE MASKS
931 F41D 39          RTS

```

```

932
933      *-----*
934      *          ZERO OUT 2 LSBS OF AZ AND EL DATA          *
935      *-----*

```

```

935 F41E A6 01      KILLSB     LDA A      1,X
936 F420 84 FC      AND A      #$FC          KILL 2 LSB'S AZ
937 F422 A7 01      STA A      1,X
938 F424 A6 03      LDA A      3,X
939 F426 84 FC      AND A      #$FC          KILL 2 LSB'S EL
940 F428 A7 03      STA A      3,X
941 F42A C6 04      LDA B      #4
942 F42C 3A          ABX          POINT TO NEXT SET
943 F42D 39          RTS

```

```

945 *-----*
946 * REMOVE INITIALIZED HC FROM CW MASKS *
947 *-----*
948 F42E CE 1094 STXT LDX #ACWMSK GET ADDR OF CW MASKS
949 F431 86 80 LDA A #80
950 F433 36 PSH A
951 F434 B6 108A LDA A HCMDBF GET HC#
952 F437 16 TAB
953 F438 84 07 AND A #807 DETERMINE WHICH...
954 F43A 57 ASR B .BYTE OF THE FOUR..
955 F43B 57 ASR B ..BYTES THE HC BIT IS
956 F43C 57 ASR B ...IN AND THEN
957 F43D 3A ABX ....POINT TO IT.
958 F43E 33 PUL B DETERMINE WHICH...
959 F43F 58 ASL B .BIT OF THE EIGHT..
960 F440 56 STXTL ROR B ..BITS IS TO BE SET
961 F441 4A DEC A ...FOR THIS HC
962 F442 2A FC BPL STXTL
963 F444 53 COM B MAKE INVERTED MASK
964 F445 17 TBA SAVE MASK FOR ALL TESTS
965 F446 E4 00 AND B 0,X REMOVE HC BIT IF IT'S...
966 F448 E7 00 STA B 0,X ..IN CORRIDOR A MASK
967 F44A 16 TAB RESTORE MASK
968 F44B E4 0D AND B $D,X REMOVE HC BIT IF IT'S...
969 F44D E7 0D STA B $D,X ..IN CORRIDOR B MASK
970 F44F 16 TAB RESTORE MASK
971 F450 E4 1A AND B $1A,X REMOVE HC BIT IF IT'S...
972 F452 E7 1A STA B $1A,X ..IN CORRIDOR C MASK
973 F454 16 TAB RESTORE MASK
974 F455 E4 27 AND B $27,X REMOVE HC BIT IF IT'S...
975 F457 E7 27 STA B $27,X ..IN CORRIDOR D MASK
976 F459 39 RTS

```

```

978 *-----*
979 *          PROCESS CORRIDOR WALK START COMMAND          *
980 *-----*
981 *          CORRIDOR A START                              *
982 *-----*
983 F45A D7 97 CCWMOV STA B CWTYPE SET FOR HCOPS
984 F45C 7E F3CA JMP CMDBP2
985 F45F F45F CMDCW EQU *
986 F45F F6 10F8 LDA B HFSTAT+1 GET CURRENT STATUS
987 F462 81 10 CMP A #$10 IS IT CORR A UP?
988 F464 26 12 BNE CMCWAD NO..CHECK A DOWN
989 F466 C4 0C AND B #$0C GET A CORR STATUS
990 F468 C1 08 CMP B #$08 ARE WE GOING DOWN NOW
991 F46A 26 05 BNE GOUPA NO..ALLS WELL
992 F46C CE 1097 LDX #ACWTX-1 YES..GET CURRENT VECTOR
993 F46F 20 03 BRA GOUPA1 START UP A
994 F471 CE 1019 GOUPA LDX #ACLLP-1 YES..POINT TO LL POINT
995 F474 C6 04 GOUPA1 LDA B #$04 SET STATUS BIT 'A UP'
996 F476 20 E2 BRA CCWMOV QUEUE UP BP COMMAND
997 *
998 F478 81 11 CMCWAD CMP A #$11 IS IT CORR A DOWN?
999 F47A 26 12 BNE CMCWBU NO..CHECK B UP
1000 F47C C4 0C AND B #$0C GET A CORR STATUS
1001 F47E C1 04 CMP B #$04 ARE WE GOING UP NOW
1002 F480 26 05 BNE GODNA NO..ALLS WELL
1003 F482 CE 1097 LDX #ACWTX-1 YES..GET CURRENT VECTOR
1004 F485 20 03 BRA GODNA1 START DOWN A
1005 F487 CE 1003 GODNA LDX #ACULP-1 YES..POINT TO UL POINT
1006 F48A C6 08 GODNA1 LDA B #$08 SET STATUS BIT 'A DN'
1007 F48C 20 CC BRA CCWMOV QUEUE UP BP COMMAND

```

```

1009 *-----*
1010 *                CORRIDOR B START                *
1011 *-----*
1012 F48E 81 12   CMCWBU  CMP A    #$12    IS IT CORR B UP?
1013 F490 26 12   BNE      CMCWBD  NO..CHECK B DOWN
1014 F492 C4 03   AND B    #$03    GET B CORR STATUS
1015 F494 C1 02   CMP B    #$02    ARE WE GOING DOWN NOW
1016 F496 26 05   BNE      GOUPB   NO..ALLS WELL
1017 F498 CE 10A4 LDX     #BCWTX-1 YES..GET CURRENT VECTOR
1018 F49B 20 03   BRA     GOUPB1  START UP B
1019 F49D CE 1026 GOUPB   LDX     #BCLLP-1 YES..POINT TO LL POINT
1020 F4A0 C6 01   GOUPB1  LDA B    #$01    SET STATUS BIT 'B UP'
1021 F4A2 20 B6   BRA     CCWMOV  QUEUE UP BP COMMAND
1022 *
1023 F4A4 81 13   CMCWBD  CMP A    #$13    IS IT CORR B DOWN?
1024 F4A6 26 12   BNE      CMCWCU  NO..CHECK C UP
1025 F4A8 C4 03   AND B    #$03    GET B CORR STATUS
1026 F4AA C1 01   CMP B    #$01    ARE WE GOING UP NOW
1027 F4AC 26 05   BNE      GODNB  NO..ALLS WELL
1028 F4AE CE 10A4 LDX     #BCWTX-1 YES..GET CURRENT VECTOR
1029 F4B1 20 03   BRA     GODNB1  START DOWN A
1030 F4B3 CE 1010 GODNB   LDX     #BCULP-1 YES..POINT TO UL POINT
1031 F4B6 C6 02   GODNB1  LDA B    #$02    SET STATUS BIT 'B DN'
1032 F4B8 20 A0   CMABFN  BRA     CCWMOV  QUEUE UP BP COMMAND

```



```

1034 *-----*
1035 *                CORRIDOR C START                *
1036 *-----*
1037 F4BA 81 14   CMCWCU  CMP A    #$14    IS IT CORR C UP?
1038 F4BC 26 12   BNE        CMCWCD  NO..CHECK C DOWN
1039 F4BE C4 C0   AND B    #$C0    GET C CORR STATUS
1040 F4C0 C1 80   CMP B    #$80    ARE WE GOING DOWN NOW
1041 F4C2 26 05   BNE        GOUPC    NO..ALLS WELL
1042 F4C4 CE 10B1 LDX     #CCWTX-1  YES..GET CURRENT VECTOR
1043 F4C7 20 03   BRA        GOUPC1  START UP C
1044 F4C9 CE 105C GOUPC    LDX     #CCLLP-1  YES..POINT TO LL POINT
1045 F4CC C6 40   GOUPC1  LDA B    #$40    SET STATUS BIT 'C UP'
1046 F4CE 20 E8   BRA        CMABFN  QUEUE UP BP COMMAND
1047 *
1048 F4D0 81 15   CMCWCD  CMP A    #$15    IS IT CORR C DOWN?
1049 F4D2 26 12   BNE        CMCWDU  NO..CHECK D UP
1050 F4D4 C4 C0   AND B    #$C0    GET C CORR STATUS
1051 F4D6 C1 40   CMP B    #$40    ARE WE GOING UP NOW
1052 F4D8 26 05   BNE        GODNC   NO..ALLS WELL
1053 F4DA CE 10B1 LDX     #CCWTX-1  YES..GET CURRENT VECTOR
1054 F4DD 20 03   BRA        GODNC1  START DOWN C
1055 F4DF CE 1046 GODNC    LDX     #CCULP-1  YES..POINT TO UL POINT
1056 F4E2 C6 80   GODNC1  LDA B    #$80    SET STATUS BIT 'C DN'
1057 F4E4 20 D2   BRA        CMABFN  QUEUE UP BP COMMAND

```

```

1114 *-----*
1115 *          CMDINI      PROCESS HFC INIT, DATA FROM HAC          *
1116 *-----*
1117 *
1118      F52F      CMDINI      EQU          *
1119 F52F CE 0099          LDX          #HACIBF
1120 F532 A6 00          LDA A          0,X          GET HEADER BYTE W/ TYPE CODE
1121 F534 0F 8D          STX          FROM          PRESET FOR DATA MOVE
1122 F536 84 F8          AND A          #SF8          MASK OUT HFC#
1123 F538 81 F8          CMP A          #SF8
1124 F53A 26 03          BNE          ICUAB          BRIF NOT HFC RESTART CODE
1125 F53C 0F          STALL      SEI          *****
1126 F53D 20 FD          BRA          *-1 ***** STALL HERE IF HAC FORCED RESTA
1127 F53F 81 C0      ICUAB      CMP A          #SC0          IS IT A+B CULPS?
1128 F541 26 08          BNE          ICLAB          NO..CHECK A+B CLLPS
1129 F543 7F 0092          CLR          INZPHZ          START NEW PHASE
1130 F546 CE 1004          LDX          #ACULP          GET TRANSFER ADDR
1131 F549 C6 08          LDA B          #S08          SAY GOT A+B CULPS
1132 F54B 4F          CLR A
1133 F54C 20 5B          BRA          INZMOV          TRANSFER TO BUFFER
1134 F54E 81 D0      ICLAB      CMP A          #SD0          IS IT A+B CLLPS??
1135 F550 26 09          BNE          IDTAB          NO..CHECK A+B DELTAS
1136 F552 CE 101A          LDX          #ACLLP          GET ADDR OF BUFFER
1137 F555 C6 10          LDA B          #S10          SAY GOT A+B CLLPS
1138 F557 86 01          LDA A          #S01          PHASE SHOULD BE 1
1139 F559 20 4E          BRA          INZMOV          TRANSFER TO BUFFER
1140 F55B 81 E0      IDTAB      CMP A          #SE0          IS IT A+B DELTAS??
1141 F55D 26 09          BNE          ICUCD          NO..TRY C+D CULPS
1142 F55F CE 1030          LDX          #ADELTA
1143 F562 C6 18          LDA B          #S18          SAY GOT A+B DELTAS
1144 F564 86 02          LDA A          #S02          PHASE SHOULD BE 2
1145 F566 20 41          BRA          INZMOV          TRANSFER DATA
1146 F568 81 90      ICUCD      CMP A          #S90          IS IT C+D CULPS
1147 F56A 26 09          BNE          ICLCD          CHECK C+D CLLPS
1148 F56C CE 1047          LDX          #CCULP
1149 F56F C6 20          LDA B          #S20          SAY GOT C+D CULPS
1150 F571 86 03          LDA A          #S03          PHASE SHOULD BE 3
1151 F573 20 34          BRA          INZMOV          TRANSFER TO BUFFER
1152 F575 81 A0      ICLCD      CMP A          #SA0          IS IT C+D CLLPS
1153 F577 26 09          BNE          IDTCD          NO..HOW ABOUT DELTAS
1154 F579 CE 105D          LDX          #CCLLP
1155 F57C C6 28          LDA B          #S28          SAY GOT C+D CLLPS
1156 F57E 86 04          LDA A          #S04          PHASE SHOULD BE 4
1157 F580 20 27          BRA          INZMOV          TRANSFER DATA
1158 F582 81 B0      IDTCD      CMP A          #SB0          IS IT C+D DELTAS??
1159 F584 26 09          BNE          CORAS          NO..HOW BOUT CORR ASSIGN
1160 F586 CE 1073          LDX          #CDELTA
1161 F589 C6 30          LDA B          #S30          SAY WE GOT DELTAS
1162 F58B 86 05          LDA A          #S05          PHASE SHOULD BE 5
1163 F58D 20 1A          BRA          INZMOV          TRANSFER DELTAS

```

```

1059 *-----*
1060 *                CORRIDOR D START                *
1061 *-----*
1062 F4E6 81 16  CMCWDU  CMP A      #$16      IS IT CORR D UP?
1063 F4E8 26 12          BNE          CMCWDD    NO..CHECK D DOWN
1064 F4EA C4 30          AND B      #$30      GET D CORR STATUS
1065 F4EC C1 20          CMP B      #$20      ARE WE GOING DOWN NOW
1066 F4EE 26 05          BNE          GOUPD     NO..ALLS WELL
1067 F4F0 CE 10BE       LDX          #DCWTX-1  YES..GET CURRENT VECTOR
1068 F4F3 20 03          BRA          GOUPD1    START UP D
1069 F4F5 CE 1069 GOUPD  LDX          #DCLLP-1  YES..POINT TO LL POINT
1070 F4F8 C6 10 GOUPD1  LDA B      #$10      SET STATUS BIT 'D UP'
1071 F4FA 20 BC          BRA          CMABFN    QUEUE UP BP COMMAND
1072 *
1073 F4FC 81 17  CMCWDD  CMP A      #$17      IS IT CORR D DOWN?
1074 F4FE 26 12          BNE          CMCWER    NO..ERROR
1075 F500 C4 30          AND B      #$30      GET D CORR STATUS
1076 F502 C1 10          CMP B      #$10      ARE WE GOING UP NOW
1077 F504 26 05          BNE          GODND     NO..ALLS WELL
1078 F506 CE 10BE       LDX          #DCWTX-1  YES..GET CURRENT VECTOR
1079 F509 20 03          BRA          GODND1    START DOWN D
1080 F50B CE 1053 GODND  LDX          #DCULP-1  YES..POINT TO UL POINT
1081 F50E C6 20 GODND1  LDA B      #$20      SET STATUS BIT 'D ON'
1082 F510 20 A6          BRA          CMABFN    QUEUE UP BP COMMAND
1083 *
1084 F512 C6 40  CMCWER  LDA B      #$40      SET COMM ERR BIT
1085 F514 FA 10F7       ORA B      HFSTAT
1086 F517 F7 10F7       STA B      HFSTAT    IN STATUS WORD
1087 F51A 39          RTS

```

| | | | | | | |
|------|------|---------|--------|-------|---------|----------------------------|
| 1165 | F58F | C6 06 | CORAS | LDA B | #6 | HAVE WE GOTTEN ALL.. |
| 1166 | F591 | D1 92 | | CMP B | INZPHZ | ..INIZ DATA?? |
| 1167 | F593 | 26 39 | | BNE | INZERR | NO..TELL HAC |
| 1168 | F595 | CE 1115 | | LDX | #CORAAS | GET ADDR TO TRXFR |
| 1169 | F598 | F6 10F7 | | LDA B | HFSTAT | GET CURRENT STATUS |
| 1170 | F598 | C4 47 | | AND B | #\$47 | STRIP OFF RST BIT |
| 1171 | F59D | CA 30 | | ORA B | #\$30 | |
| 1172 | F59F | F7 10F7 | | STA B | HFSTAT | WE NOW SHOW INITIALIZED |
| 1173 | F5A2 | 7C 008E | | INC | FROM+1 | PIG CODE FROM A00 |
| 1174 | F5A5 | C6 F0 | | LDA B | #=16 | SET TRANSFER COUNT |
| 1175 | F5A7 | 20 21 | | BRA | INZMV3 | TRANSFER DATA |
| 1176 | | | * | | | |
| 1177 | F5A9 | 91 92 | INZMOV | CMP A | INZPHZ | AT PROPER PHASE?? |
| 1178 | F5AB | 26 21 | | BNE | INZERR | IF NOT..RESET |
| 1179 | F5AD | 7C 0092 | | INC | INZPHZ | INC PHASE COUNTER |
| 1180 | F5B0 | 86 C7 | | LDA A | #\$C7 | |
| 1181 | F5B2 | B4 10F7 | | AND A | HFSTAT | STRIP INIT PHASE BITS |
| 1182 | F5B5 | B7 10F7 | | STA A | HFSTAT | |
| 1183 | F5B8 | CA 80 | | ORA B | #\$80 | SET RST BIT |
| 1184 | F5BA | FA 10F7 | | ORA B | HFSTAT | OR IN CURRENT STATUS |
| 1185 | F5BD | F7 10F7 | | STA B | HFSTAT | ..IN STATUS WORD |
| 1186 | F5C0 | C6 F7 | | LDA B | #=9 | SET UP COUNT FOR MOVE |
| 1187 | F5C2 | BD F51B | | JSR | MOVE | MOVE VEC OR DELTA |
| 1188 | F5C5 | C6 04 | | LDA B | #4 | SKIP OVER COUNT DATA |
| 1189 | F5C7 | 3A | | ABX | | |
| 1190 | F5C8 | C6 F7 | | LDA B | #=9 | SET UP COUNT AGAIN |
| 1191 | F5CA | BD F51B | INZMV3 | JSR | MOVE | MOVE INIT DATA TO HOLD BUF |
| 1192 | F5CD | 39 | | RTS | | |
| 1193 | | | * | | | |
| 1194 | F5CE | B6 10F7 | INZERR | LDA A | HFSTAT | |
| 1195 | F5D1 | 84 C7 | | AND A | #\$C7 | RESET INIT PHASE |
| 1196 | F5D3 | 8A 80 | | ORA A | #\$80 | ..SET RESTART |
| 1197 | F5D5 | B7 10F7 | | STA A | HFSTAT | |
| 1198 | F5D8 | 4F | | CLR A | | |
| 1199 | F5D9 | 97 92 | | STA A | INZPHZ | RESET INTERNAL INIT PHASE |
| 1200 | F5DB | 39 | | RTS | | |

```

1202 *-----*
1203 *          ROUTINE TO REVERSE COORD BYTES FOR HC          *
1204 *-----*
1205 F5DC C6 FD  RVR99  LDA B      #-3
1206 F5DE A6 00  RVR93  LDA A      0,X          MS BYTE
1207 F5E0 36          PSH A
1208 F5E1 A6 02          LDA A      2,X          LS BYTE
1209 F5E3 A7 00          STA A      0,X
1210 F5E5 32          PUL A          GET BACK MS BYTE
1211 F5E6 A7 02          STA A      2,X
1212 F5E8 08          INX
1213 F5E9 08          INX          POINT TO NEXT COORD
1214 F5EA 08          INX
1215 F5EB 5C          INC B
1216 F5EC 2B F0          BMI      RVR93          DO FOR X,Y,Z
1217 F5EE C6 04          LDA B      #4          SET UP FOR CALLER
1218 F5F0 3A          ABX
1219 F5F1 39          RTS
1220 *
1221 *-----*
1222 *          REVERSE SUN,CWA,CWB,BP/HCINIT COORDS          *
1223 *-----*
1224 F5F2 CE 108B HCRVRS  LDX      #SX          POINT TO SUN COORDS
1225 F5F5 8D E5          BSR      RVR99          REVERSE SUN COORDS
1226 F5F7 8D E3          BSR      RVR99          REVERSE CW=A COORDS
1227 F5F9 8D E1          BSR      RVR99          REVERSE CW=B COORDS
1228 F5FB 8D DF          BSR      RVR99          REVERSE CW=C COORDS
1229 F5FD 8D DD          BSR      RVR99          REVERSE CW=D COORDS
1230 F5FF 3A          ABX          BUMP 4 MORE
1231 F600 8D DA          BSR      RVR99          REVERSE BP/HCINIT COORDS
1232 F602 39          RTS

```

```

1234 *-----*
1235 *          HCOPS          PERFORM HC OPERATIONS          *
1236 *-----*
1237 *
1238          F603          HCOPS          EQU          *
1239 F603 8D ED          BSR          HCRVRS          REVERSE FIELD COORDS FOR HC
1240 F605 8D 0E          BSR          HCOSSC          OUTPUT SUN/SYNC/CMD TO HC'S
1241 F607 8D E9          BSR          HCRVRS          RETURN TO NORMAL FOR ME
1242 F609 8D 74          BSR          HCOCRD          RECEIVE HC CMD RESPONSES
1243 F60B 8D F6E9          JSR          HCOPOL          POLL 4 HC'S FOR STATUS
1244 F60E C6 08          LDA B          #8          CODE FOR CWCALC ACTIVATE
1245 F610 86 FF          LDA A          #-1          CODE FOR CMDI REENTER
1246 F612 7E F267          JMP          CMDIRTN

```

```

1248 *-----*
1249 * HCOSSC OUTPUT SUN/SYNC/CMD PACKET & *
1250 * TRANSFER CORR.WALK DATA FROM BP SLOT *
1251 * TO A OR B CW SLOT. *
1252 *-----*
1253 F615 HCOSSC EQU * OUTPUT SUN/SYNC/CMD TO HC'S
1254 F615 CE 108A LDX #HCMDBF
1255 F618 86 4F LDA A #79 CMD BUJ ADR & BYTE COUNT
1256 F61A BD F093 JSR HCWRT WRITE TO HC BUS
1257 F61D A6 00 LDA A 0,X HCMDBF
1258 F61F 84 F0 AND A #$F0 CHECK HDR BYTE
1259 F621 81 30 CMP A #$30
1260 F623 26 43 BNE SSCNCW BRIF NOT CW START-UP
1261 F625 CE 10C7 LDX #HCMDSK-1
1262 F628 DF 8D STX FROM SET MOVE FROM ADDR
1263 F62A 96 97 MOVCWA LDA A CWTYPE
1264 F62C 85 0C BIT A #$0C IS IT A CW??
1265 F62E 27 07 BEQ MOVCWB NO BITS SET..TRY B
1266 F630 CE 1094 LDX #ACWMSK
1267 F633 C6 F3 LDA B #$F3 REMOVE CURRENT A
1268 F635 20 1B BRA MVMSK ..CORR STATUS
1269 *
1270 F637 85 03 MOVCWB BIT A #$03 IS IT B CW??
1271 F639 27 07 BEQ MOVCWC NO BITS SET..TRY C
1272 F63B CE 10A1 LDX #BCWMSK
1273 F63E C6 FC LDA B #$FC REMOVE CURRENT B
1274 F640 20 10 BRA MVMSK ..CORR STATUS
1275 *
1276 F642 85 C0 MOVCWC BIT A #$C0 IS IT C CW??
1277 F644 27 07 BEQ MOVCWD NO BITS SET..TRY D
1278 F646 CE 10AE LDX #CCWMSK
1279 F649 C6 3F LDA B #$3F REMOVE CURRENT C
1280 F64B 20 05 BRA MVMSK ..CORR STATUS
1281 *
1282 F64D CE 10BB MOVCWD LDX #DCWMSK MUST BE D
1283 F650 C6 CF LDA B #$CF REMOVE CURRENT D
1284 *
1285 F652 F4 10F8 MVMSK AND B HFSTAT+1
1286 F655 1B ABA SET CORR STATUS
1287 F656 B7 10F8 STA A HFSTAT+1
1288 F659 C6 FC LDA B #-4
1289 F65B BD F51B JSR MOVE MOVE 4 BYTE CMD MASK
1290 F65E CC 10CF LDD #BPX-1
1291 F661 DD 8D STD FROM
1292 F663 C6 F7 LDA B #-9
1293 F665 BD F51B JSR MOVE MOVE 9 BYTE COORD
1294 *
1295 F668 SSCNCW EQU *
1296 F668 CE 1000 LDX #HFCRAM
1297 F66B 4F CLR A

```

| | | | | | | | |
|------|------|----|------|-----|--------|--------|------------------------|
| 1298 | F66C | 5F | | CLR | B | | |
| 1299 | F66D | 7D | 0093 | TST | | ECWFLG | IS ECW ACTIVE?? |
| 1300 | F670 | 28 | 04 | BMI | | CLRCRM | IF SO..DONT CLR CMD |
| 1301 | F672 | ED | C8 | STD | | SC8,X | CLEAR 32-BIT HC |
| 1302 | F674 | ED | CA | STD | | SCA,X | COMMAND MASK |
| 1303 | F676 | ED | DB | STD | CLRCRM | SDB,X | CLR 32-BIT HC |
| 1304 | F678 | ED | DD | STD | | SDD,X | CMD RETURN MASK |
| 1305 | F67A | 86 | 7F | LDA | A | #87F | |
| 1306 | F67C | A7 | 8A | STA | A | \$8A,X | RESET HDR BYTE IN CASE |
| 1307 | F67E | 39 | | RTS | | | IT WAS HC INIT CMD |


```

1309 *-----*
1310 * HCOCRR READ CMD RESPONSE & MAKE UP CRMASK *
1311 *-----*
1312 F67F HCOCRR EQU * RECEIVE HC COMMAND RESPONSE
1313 F67F 86 3C LDA A #60
1314 F681 97 81 STA A DLYTMR APPROX. 50MS DELAY
1315 F683 8D F072 JSR HCRD READ THE RESPONSE
1316 *
1317 F686 96 81 CRRW1 LDA A DLYTMR
1318 F688 2A FC BPL CRRW1 GIVE HC'S TIME TO RESPOND
1319 F68A 86 4B LDA A #75
1320 F68C 97 81 STA A DLYTMR APPROX. 60MS DELAY
1321 F68E 96 81 CRRW2 LDA A DLYTMR
1322 F690 2A FC BPL CRRW2 GIVE HC'S MORE TIME
1323 F692 86 0A LDA A #50A
1324 F694 97 11 STA A SIOCSR TURN OFF SERIAL I/O
1325 F696 96 88 LDA A HCIST HC INPUT STATUS
1326 F698 48 ASL A
1327 F699 2B 4D BMI CRNONE BRIF OR/FE OR IRQ=NO=REASON
1328 F69B 86 20 LDA A #32
1329 F69D 90 85 SUB A IOTC GET +NUMBER OF HC'S WHICH TAL
1330 F69F 27 47 BEQ CRNONE BRIF NOBODY COMMANDED
1331 F6A1 4A DEC A
1332 F6A2 97 8B STA A CTR
1333 F6A4 CE 0099 LDX #HCIBUF WHERE RESPONSE IS
1334 *
1335 F6A7 CRLOOP EQU * DO FOR EACH RESP. BYTE
1336 F6A7 A6 00 LDA A 0,X RESPONSE BYTE
1337 F6A9 16 TAB
1338 F6AA 88 C0 EOR A #5C0 ISOLATE & CHECK HDR CODE
1339 F6AC 84 E0 AND A #5E0
1340 F6AE 26 32 BNE NGRP3 BRIF WRONG HDR CODE
1341 F6B0 C4 07 AND B #507 GET 1 OF 8 IN SUB-GROUP
1342 F6B2 4F CLR A
1343 F6B3 0D SEC RESPONSE BIT 2 B POSITIONED
1344 F6B4 46 ROR A POSITION BIT VIA LAST 3-BITS
1345 F6B5 5A DEC B OF THE HC#.
1346 F6B6 2A FC BPL *-2
1347 F6B8 E6 00 LDA B 0,X GET BACK THE RESP. BYTE
1348 F6BA 54 LSR B
1349 F6BB 54 LSR B ISOLATE 1 OF 4 SUB-GROUPS TO
1350 F6BC 54 LSR B FIND WHICH BYTE OF THE 32-BIT
1351 F6BD C4 03 AND B #503 WORD TO SET.
1352 F6BF 26 06 BNE NGRP0 BRIF NOT IN FIRST BYTE
1353 F6C1 BA 10DB ORA A CRMASK
1354 F6C4 B7 10DB STA A CRMASK SET BIT IN CORRECT BYTE
1355 *
1356 F6C7 5A NGRP0 DEC B
1357 F6C8 26 06 BNE NGRP1 BRIF NOT 2ND BYTE
1358 F6CA BA 10DC ORA A CRMASK+1

```

C00 13:24 JAN 27, '84

MMC M6801/M6803 MPU ASSEMBLER

PAGE 42

| | | | | | | | |
|------|------|----|------|--------|-------|----------|--------------------------|
| 1359 | F6CD | B7 | 10DC | | STA A | CRMASK+1 | SET BIT IN CORRECT BYTE |
| 1360 | F6D0 | 5A | | NGRP1 | DEC B | | |
| 1361 | F6D1 | 26 | 06 | | BNE | NGRP2 | BRIF NOT 3RD BYTE |
| 1362 | F6D3 | BA | 10DD | | ORA A | CRMASK+2 | |
| 1363 | F6D6 | B7 | 10DD | | STA A | CRMASK+2 | SET BIT IN CORRECT BYTE |
| 1364 | F6D9 | 5A | | NGRP2 | DEC R | | |
| 1365 | F6DA | 26 | 06 | | BNE | NGRP3 | BRIF NOT 4TH BYTE |
| 1366 | F6DC | BA | 10DE | | ORA A | CRMASK+3 | |
| 1367 | F6DF | B7 | 10DE | | STA A | CRMASK+3 | SET BIT IN CORRECT BYTE |
| 1368 | F6E2 | 08 | | NGRP3 | INX | | POINT TO NEXT RESP. BYTE |
| 1369 | F6E3 | 7A | 008B | | DEC | CTR | |
| 1370 | F6E6 | 2A | BF | | RPL | CRLOOP | DO FOR ALL RESP. BYTES |
| 1371 | F6E8 | 39 | | CRNONE | RTS | | |

```

1373
1374      *-----*
1375      * HCOPOL      STATUS 4 HC'S & MAKE STAT BUF FOR HAC *
1376      *-----*
1376      F6E9      HCOPOL      EQU      *      STATUS POLL 4 HC'S & REFORMAT
1377      F6E9 96 8A      LDA A      SPNUM
1378      F6E8 84 1F      AND A      #$1F      KILL HIGH ORDER BITS
1379      F6E0 97 8A      STA A      SPNUM
1380      F6EF 5F      CLR B
1381      F6F0 96 02      LDA A      P1DATA      GET HFC ADDRESS
1382      F6F2 04      LSR D
1383      F6F3 04      LSR D      PUT IN HI END OF RB
1384      F6F4 04      LSR D
1385      F6F5 0B 8A      ADD B      SPNUM
1386      F6F7 86 50      LDA A      #$50      HEADER BYTE
1387      F6F9 FD 10D9     STD      HACSTAT     SET 2 HDR BYTES IN O/P BUF
1388      F6FC C6 03      LDA B      #3
1389      F6FE D7 8B      STA B      CTR      SET LOOP FOR 4 HC'S
1390      F700 CE 10DF     LDX      #HACSTAT+6  WHERE TO STORE
1391
1392      F703 86 01      *
1393      F705 97 81      HCPLP     LDA A      #1      HC POLLING LOOP
1394      F707 96 81      STA A      DLYTMR
1395      F709 2A FC      HCPWAT   LDA A      DLYTMR
1396      F70B 8D F71A     BPL      HCPWAT     DELAY 833 USEC BETWEEN I/O'S
1397      F70E C6 06      JSR      POL1HC    STATUS POLL 1 HC
1398      F710 3A      LDA B      #6
1399      F711 7C 008A     ARX      POINT TO NXT SLOT IN HAC STAT
1400      F714 7A 008B     INC      TO GET NEXT HC
1401      F717 2A EA      DEC      CTR
1402      F719 39      BPL      HCPWAT    DO FOR 4 HC'S
                        RTS

```

```

1404 *-----*
1405 * POL1HC STATUS POLL 1 HC SUBROUTINE *
1406 *-----*
1407 F71A POL1HC EQU *
1408 F71A 3C PSH X
1409 F71B 96 8A LDA A SPNUM WHICH HC TO POLL
1410 F71D 8A 80 ORA A #580 HDR CODE
1411 F71F 97 98 STA A SPOLBF STATUS POLL O/P BUF
1412 F721 CE 0098 LDX #SPOLBF
1413 F724 86 01 LDA A #1 XFR ADDR & BYTE COUNT
1414 F726 BD F093 JSR HCWRT WRITE TO HC BUS
1415 * & WAIT FOR I/O CMPLTN
1416 F729 86 06 LDA A #6
1417 F72B 97 80 STA A IOTMR 5.0 MS TIME-OUT TILL 1ST BYTE
1418 F72D BD F072 JSR HCRD READ HC RESPONSE
1419 F730 96 80 P2WAT LDA A IOTMR
1420 F732 2A FC BPL P2WAT WAIT TILL I/O DONE
1421 F734 86 0A LDA A #50A
1422 F736 97 11 STA A SIOCSR TURN OFF SERIAL I/O
1423 F738 38 PUL X
1424 F739 96 88 LDA A HCIST SERIAL I/O STATUS
1425 F73B 48 ASL A
1426 F73C 2B 12 BMI HCPERR BRIF OR/FE OR IRQ-NO-REASON
1427 F73E 96 85 LDA A IOTC RESPONSE BYTE COUNT
1428 F740 81 18 CMP A #24
1429 F742 26 0C BNE HCPERR BRIF BAD RESP. LENGTH
1430 F744 96 86 LDA A IOCKSM
1431 F746 26 08 BNE HCPERR BRIF BAD CHECKSUM
1432 F748 96 8A LDA A SPNUM STAT-POLL HC NUMBER
1433 F74A 8B A0 ADD A #5A0 HDR CODE
1434 F74C 98 99 EOR A HCIBUF
1435 F74E 27 06 BEQ HCPGOOD BRIF GOOD HC# RETURNED
1436 F750 CC 0400 HCPERR LDD #50400
1437 F753 ED 00 STD 0,X SET 'HFC DETECTED COMERR' BIT
1438 F755 39 RTS
1439 *
1440 F756 8D 0D HCPGOOD BSR SCREEN SCREEN C.W. POSN CMPR BITS
1441 F758 DC 9A LDD HCIBUF+1
1442 F75A ED 00 STD 0,X MOVE HC STATUS
1443 F75C DC 9C LDD HCIBUF+3
1444 F75E ED 02 STD 2,X MOVE AZIMUTH
1445 F760 DC 9E LDD HCIBUF+5
1446 F762 ED 04 STD 4,X MOVE ELEVATION
1447 F764 39 RTS

```

```

1449 *-----*
1450 * SCREEN OUT POSN CMPR BITS FOR THOSE HC'S WHICH *
1451 * ARE CURRENTLY CORRIDOR WALKING *
1452 *-----*
1453 F765 SCREEN EQU *
1454 F765 3C PSH X
1455 F766 F6 10F8 LDA B HFSTAT+1 GET CORR, STATUS'S
1456 F769 27 36 BEQ NOHCWW OUT,,QUICK NO CW'S
1457 F76B C5 0C ACWHC BIT B #S0C IS A ACTIVE?
1458 F76D 27 09 BEQ BCWHC BRIF NOBODY ON WIRE=A
1459 F76F CE 1094 LDX #ACWMSK CORR, A CMD MASK
1460 F772 96 8A LDA A SPNUM GET THIS HC NUMBER
1461 F774 8D 2D BSR MSKBIT SEE IF HC ON THIS WIRE
1462 F776 25 23 BCS PCKILL YES,,HC CORR WALKING
1463 *
1464 F778 C5 03 BCWHC BIT B #S03 IS B ACTIVE?
1465 F77A 27 09 BEQ CCWHC BRIF NOBODY ON WIRE=B
1466 F77C CE 10A1 LDX #BCWMSK CORR, B CMD MASK
1467 F77F 96 8A LDA A SPNUM GET THIS HC NUMBER
1468 F781 8D 20 BSR MSKBIT IS HC ON B WIRE
1469 F783 25 16 BCS PCKILL YES,,HC CORR WALKING
1470 *
1471 F785 C5 C0 CCWHC BIT B #S00 IS C ACTIVE?
1472 F787 27 09 BEQ DCWHC BRIF NOBODY ON WIRE=C
1473 F789 CE 10AE LDX #CCWMSK CORR, C CMD MASK
1474 F78C 96 8A LDA A SPNUM HC WE'RE INTERESTED IN
1475 F78E 8D 13 BSR MSKBIT IS HE ON C WIRE?
1476 F790 25 09 BCS PCKILL YES,,HC CORR WALKING
1477 *
1478 F792 CE 10BB DCWHC LDX #DCWMSK CORR, D CMD MASK
1479 F795 96 8A LDA A SPNUM HC WE'RE INTERESTED IN
1480 F797 8D 0A BSR MSKBIT PUT HC'S CMD BIT IN CAR
1481 F799 24 06 BCC NOHCWW NOT ON D WIRE,,GET OUT
1482 *
1483 F79B 96 9A PCKILL LDA A HCIBUF+1 GET HC'S STATUS
1484 F79D 84 DF AND A #SDF
1485 F79F 97 9A STA A HCIBUF+1 KILL THIS HC'S PC BIT
1486 F7A1 38 NOHCWW PUL X
1487 F7A2 39 RTS

```

```

1489 *-----*
1490 * MSKBIT SUBROUTINE PLACES THE BIT CORRESPONDING *
1491 * TO THE BIT POSITION IN THE A-REG INTO *
1492 * THE CARRY FLAG FOR USER TO TEST --- *
1493 * STARTS AT BIT-7 OF BYTE POINTED TO BY *
1494 * X-REG. AREG BIT POSN'S ARE 0-N *
1495 *-----*
1496 F7A3 MSKBIT EQU *
1497 F7A3 37 PSH B SAVE USER'S B-REG
1498 F7A4 16 TAB
1499 F7A5 84 07 AND A #7 MASK TO BIT WITHIN BYTE
1500 F7A7 54 LSR B
1501 F7A8 54 LSR B RIGHT JUSTIFY
1502 F7A9 54 LSR B
1503 F7AA C4 03 AND B #3
1504 F7AC 3A ABX
1505 F7AD E6 00 LDA B 0,X GET CORRECT BYTE IN MULTI-BYTE
1506 F7AF 59 ROL B
1507 F7B0 4A DEC A
1508 F7B1 2A FC BPL **2 PUT BIT INTO CARRY
1509 F7B3 33 PUL B RESTORE USER'S B-REG
1510 F7B4 39 RTS

```

```

1512 *-----*
1513 *   CWCALC   CORRIDOR WALK CALCULATION PROGRAM   *
1514 *-----*
1515 *           PROCESS CORRIDORS A AND B           *
1516 *-----*
1517      F7B5   CWCALC   EQU           *
1518 F7B5 B6 10F8   LDA A       HFSTAT+1   GET CW STATUS
1519 F7B8 27 51     BEQ         CWIDLE     ANYTHING ACTIVE??
1520 *
1521 F7BA 85 0C   CKCWA   BIT A       #$0C     YES..IS IT A
1522 F7BC 27 0F     BEQ         CKWWB     NO..CHECK B
1523 F7BE CE 1004   LDX         #ACULP
1524 F7C1 36       PSH A           SAVE STATUS FOR B
1525 F7C2 44       LSR A           SHIFT TO END
1526 F7C3 44       LSR A
1527 F7C4 8D 4C   BSR         CKDELTAB   WIRE WALK EM
1528 F7C6 32       PUL A           GET BACK STATUS
1529 F7C7 25 04   BCS         CKWWB     IF C SET WIRE ACTIVE
1530 F7C9 C6 F3   LDA B       #$F3     IF CLEAR..STOP IT
1531 F7CB 8D 5D   BSR         STOPCWAB
1532 *
1533 F7CD 85 03   CKWWB   BIT A       #$03     IS B ACTIVE STILL
1534 F7CF 27 0D     BEQ         CKWWC     NO..CHECK C
1535 F7D1 CE 1011   LDX         #BCULP
1536 F7D4 36       PSH A           SAVE STATUS
1537 F7D5 8D 3B   BSR         CKDELTAB   WIRE WALK B
1538 F7D7 32       PUL A
1539 F7D8 25 04   BCS         CKWWC     IF CLEAR THEN
1540 F7DA C6 FC   LDA B       #$FC
1541 F7DC 8D 4C   BSR         STOPCWAB

```

```

1543 *-----*
1544 *          PROCESS CORRIDOR C AND D          *
1545 *-----*
1546 F7DE 85 C0 CKWWC BIT A #S0 IS C ACTIVE
1547 F7E0 27 15 BEQ CKWWD NO..MUST RE D
1548 F7E2 CE 1047 LDX #CCULP
1549 F7E5 36 PSH A
1550 F7E6 44 LSR A SHIFT TO
1551 F7E7 44 LSR A LAST TWO
1552 F7E8 44 LSR A BIT HOLES
1553 F7E9 44 LSR A
1554 F7EA 44 LSR A
1555 F7EB 44 LSR A
1556 F7EC BD F883 JSR CKDELTCO WIRE WALK
1557 F7EF 32 PIJL A GET STATUS BACK
1558 F7F0 25 05 BCS CKWWD IF ACTIVE CHECK D
1559 F7F2 C6 3F LDA B #S3F
1560 F7F4 BD F89B JSR STOPCWCD
1561 *
1562 F7F7 85 30 CKWWD BIT A #S30 IS D ACTIVE??
1563 F7F9 27 10 BEQ CWIDLE NO..EXIT
1564 F7FB CE 1054 LDX #DCULP
1565 F7FE 44 LSR A SHIFT TO
1566 F7FF 44 LSR A LS TWO
1567 F800 44 LSR A BITS
1568 F801 44 LSR A
1569 F802 8D 7F BSR CKDELTCO
1570 F804 25 05 BCS CWIDLE IF SET STILL ACTIVE
1571 F806 C6 CF LDA B #S3F IF CLEAR STOP IT
1572 F808 BD F89B JSR STOPCWCD
1573 F80B 86 FF CWIDLE LDA A #-1 SET RE ENTER CODE
1574 F80D C6 09 LDA B #9 SAFE FOR ANOTHER
1575 F80F 7E F267 JMP CMDIRTN SECOND

```



```

1577 *-----*
1578 *          CWCALC SUBROUTINES FOR CORR'S A AND B          *
1579 *-----*
1580 F812 84 03  CKDELTA B AND A      #$03      GET UP OR DOWN
1581 F814 85 02          RIT A      #$02      IS IT DOWN??
1582 F816 26 08          RNE          CWDNAB    YES..DO IT
1583 F818 8D 2F  CWUPAB  BSR          DELTUPAB ITS UP
1584 F81A 2B 0C          BMI          CWSTOPAB ITS PAST LIMIT
1585 F81C 8D 15          BSR          CKUPNDAB CHECK LIMIT POINT
1586 F81E 0D          CWCENDAB SEC          STILL ACTIVE
1587 F81F 39          RTS
1588 *
1589 F820 8D 44  CWDNAB  BSR          DELTDNAB ITS DOWN
1590 F822 2B 04          BMI          CWSTOPAB IT THERE..QUIT
1591 F824 8D 18          BSR          CKDNNDAB CHECK LIMIT POINT
1592 F826 20 F6          BRA          CWCENDAB STILL ACTIVE
1593 *
1594 F828 0C          CWSTOPAB CLC
1595 F829 39          RTS
1596 *
1597 F82A F4 10F8 STOPCWAB AND B      HFSTAT+1
1598 F82D F7 10F8          STA B      HFSTAT+1
1599 F830 6F 35          CLR          53,X      CW FLAG
1600 F832 39          RTS
1601 *
1602 F833 EC 07  CKUPNDAB LDD          7,X      CULP+1      TEST IF EXCEEDED EITHER
1603 F835 A3 9B          SUB D      $9B,X    TZ+1          ACULP OR BCULP THEN
1604 F837 A6 06          LDA A      6,X      CULP          STORE RESULTS (EITHER
1605 F839 A2 9A          SBC A      $9A,X    TZ          POS. OR NEG.) INTO
1606 F83B A7 35          STA A      53,X    CWFLG          EITHER ACWFLG OR
1607 F83D 39          RTS          BCWFLG
1608 *
1609 F83E EC 9B  CKDNNDAB LDD          $9B,X    TZ+1          TEST IF EXCEEDED EITHER
1610 F840 A3 1D          SUB D      29,X    CLLP+1          ACLLP OR BCLLP THEN
1611 F842 A6 9A          LDA A      $9A,X    TZ          STORE RESULTS (EITHER
1612 F844 A2 1C          SBC A      28,X    CLLP          POS. OR NEG.) INTO
1613 F846 A7 35          STA A      53,X    CWFLG          EITHER ACWFLG OR
1614 F848 39          RTS          BCWFLG

```

```

1616 *-----*
1617 * DELTUPAB CWCALC SUB TO ADD DELTAS TO *
1618 * TO TARGET COORDINATES *
1619 *-----*
1620 F849 DELTUPAB EQU * X-REG POINTS TO EITHER ACULP
1621 F849 3C PSH X OR BCULP
1622 F84A C6 FD LDA B #-3 X,Y,Z
1623 F84C D7 8B STA R CTR
1624 *
1625 F84E EC 95 DUPLPAB LDD $95,X CMD COORD LS 2 BYTES
1626 F850 E3 2D ADD D $2D,X DELTA LS 2 BYTES
1627 F852 ED 95 STD $95,X
1628 F854 A6 94 LDA A $94,X CMD COORD MS BYTE
1629 F856 A9 2C ADC A $2C,X DELTA MS BYTE
1630 F858 A7 94 STA A $94,X
1631 F85A 08 INX
1632 F85B 08 INX UPDATE X-REG & LOOP COUNT
1633 F85C 08 INX
1634 F85D 7C 008B INC CTR
1635 F860 2B EC BMI DUPLPAB DO FOR X,Y,Z
1636 F862 38 PUL X
1637 F863 A6 35 LDA A 53,X PICK UP CWFLG FOR USER
1638 F865 39 RTS

```

```

1640 -----*
1641 * DELTDNAB DELTA=DOWN THE CORRIDOR COORDS A AND B *
1642 -----*
1643 F866 DELTDNAB EQU * X-REG POINTS TO EITHER ACULP
1644 F866 3C PSH X OR BCULP
1645 F867 C6 FD LDA B #-3
1646 F869 D7 8B STA B CTR X,Y,Z
1647 *
1648 F86B EC 95 DDNLPAB LDD $95,X CMD COORD LS 2 BYTES
1649 F86D A3 2D SUB D $2D,X DELTA LS 2 BYTES
1650 F86F ED 95 STD $95,X
1651 F871 A6 94 LDA A $94,X CMD COORD MS BYTE
1652 F873 A2 2C SBC A $2C,X DELTA MS BYTE
1653 F875 A7 94 STA A $94,X
1654 F877 08 INX
1655 F878 08 INX UPDATE X-REG & LOOP COUNT
1656 F879 08 INX
1657 F87A 7C 008B INC CTR
1658 F87D 2B EC BMI DDNLPAB DO FOR X,Y,Z
1659 F87F 38 PUL X
1660 F880 A6 35 LDA A 53,X GET CWFLG FOR USER
1661 F882 39 RTS

```

```

1663 *-----*
1664 *          CWCALC SUBROUTINES FOR CORR'S C AND D          *
1665 *-----*
1666 F883 84 03  CKDELTCO AND A  #S03  GET UP OR DOWN
1667 F885 85 02          RIT A  #S02  IS IT DOWN??
1668 F887 26 08          BNE          CWDNCD  YES..DO IT
1669 F889 8D 2F  CWUPCD  BSR          DELTUPCD  ITS UP
1670 F88R 2B 0C          BMI          CWSTOPCD  ITS PAST LIMIT
1671 F88D 8D 15          BSR          CKUPNDCD  CHECK LIMIT POINT
1672 F88F 0D          CWCENDCD SEC          STILL ACTIVE
1673 F890 39          RTS
1674 *
1675 F891 8D 44  CWDNCD  BSR          DELTDNCD  ITS DOWN
1676 F893 2B 04          BMI          CWSTOPCD  IT THERE..QUIT
1677 F895 8D 18          BSR          CKDNDCD  CHECK LIMIT POINT
1678 F897 20 F6          BRA          CWCENDCD  STILL ACTIVE
1679 *
1680 F899 0C          CWSTOPCD CLC
1681 F89A 39          RTS
1682 *
1683 F89B F4 10F8 STOPCWCD AND B  HFSTAT+1
1684 F89E F7 10F8          STA B  HFSTAT+1
1685 F8A1 6F 35          CLR          53,X  CW FLAG
1686 F8A3 39          RTS
1687 *
1688 F8A4 EC 07  CKUPNDCD LDD          7,X  CULP+1  TEST IF EXCEEDED EITHER
1689 F8A6 A3 72          SUB D  $72,X  TZ+1  CCULP OR DCULP THEN
1690 F8A8 A6 06          LDA A  6,X  CULP  STORE RESULTS (EITHER
1691 F8AA A2 71          SRC A  $71,X  TZ  POS. OR NEG.) INTO
1692 F8AC A7 35          STA A  53,X  CWFLG  EITHER CCWFLG OR
1693 F8AE 39          RTS  DCWFLG
1694 *
1695 F8AF EC 72  CKDNDCD  LDD          $72,X  TZ+1  TEST IF EXCEEDED EITHER
1696 F8B1 A3 1D          SUB D  29,X  CLLP+1  CCLLP OR DCLLP THEN
1697 F8B3 A6 71          LDA A  $71,X  TZ  STORE RESULTS (EITHER
1698 F8B5 A2 1C          SRC A  28,X  CLLP  POS. OR NEG.) INTO
1699 F8B7 A7 35          STA A  53,X  CWFLG  EITHER CCWFLG OR
1700 F8B9 39          RTS  DCWFLG

```

```

1702 *-----*
1703 * DELTUPAB CWCALC SUB TO ADD DELTAS TO *
1704 * TO TARGET COORDINATES OF C AND D *
1705 *-----*
1706 F88A DELTUPCD EQU * X=REG POINTS TO EITHER CCULP
1707 F88A 3C PSH X OR DCULP
1708 F88B C6 FD LDA B #=3 X,Y,Z
1709 F88D D7 8B STA B CTR
1710 *
1711 F8BF EC 6C DUPLPCD LDD $6C,X CMD COORD LS 2 BYTES
1712 F8C1 E3 2D ADD D $2D,X DELTA LS 2 BYTES
1713 F8C3 ED 6C STD $6C,X
1714 F8C5 A6 6B LDA A $6B,X CMD COORD MS BYTE
1715 F8C7 A9 2C ADC A $2C,X DELTA MS BYTE
1716 F8C9 A7 6B STA A $6B,X
1717 F8CB 08 INX
1718 F8CC 08 INX UPDATE X=REG & LOOP COUNT
1719 F8CD 08 INX
1720 F8CE 7C 008B INC CTR
1721 F8D1 2B EC BMI DUPLPCD DO FOR X,Y,Z
1722 F8D3 38 PUL X
1723 F8D4 A6 35 LDA A 53,X PICK UP CWFLG FOR USER
1724 F8D6 39 RTS

```

```

1726 -----*
1727 * DELTDNCD DELTA-DOWN THE CORRIDOR COORDS C AND D *
1728 -----*
1729 F8D7 DELTDNCD EQU * X-REG POINTS TO EITHER CCULP
1730 F8D7 3C PSH X OR DCULP
1731 F8D8 C6 FD LDA B #-3
1732 F8DA D7 8B STA B CTR X,Y,Z
1733 *
1734 F8DC EC 6C DDNLPCD LDD $6C,X CMD COORD LS 2 BYTES
1735 F8DE A3 2D SUB D $2D,X DELTA LS 2 BYTES
1736 F8E0 ED 6C STD $6C,X
1737 F8E2 A6 6B LDA A $6B,X CMD COORD MS BYTE
1738 F8E4 A2 2C SBC A $2C,X DELTA MS BYTE
1739 F8E6 A7 6B STA A $6B,X
1740 F8E8 08 INX
1741 F8E9 08 INX UPDATE X-REG & LOOP COUNT
1742 F8EA 08 INX
1743 F8EB 7C 008B INC CTR
1744 F8EE 2B EC BMI DDNLPCD DO FOR X,Y,Z
1745 F8F0 38 PUL X
1746 F8F1 A6 35 LDA A 53,X GET CWFLG FOR USER
1747 F8F3 39 RTS
    
```

```
1749 *-----*
1750 *   ECWOPS   EMERGENCY CORRIDOR WALK OPERATIONS *
1751 *-----*
1752      F8F4   ECWOPS   EQU   *   MAIN ROUTINE
1753 F8F4 96 93      LDA A   ECWFLG
1754 F8F6 2A 09      BPL     NOECW   BRIF ECWOPS NOT ENA'D
1755 F8F8 8D 0D      BSR     ECWMG   GENERATE MODE MASKS
1756 F8FA 8D F9FD    JSR     ECWSEQ  SEQUENCE E.C.W OPERATIONS
1757 F8FD 4F         CLR A
1758 F8FE 7E F267   JMP     CMDIRTN  RETURN TO CMDI
1759
1760      F901   *   NOECW   EQU   *
1761 F901 4F         CLR A
1762 F902 97 94      STA A   ECWPHZ   INSURE STARTING PHASE
1763 F904 7E F267   JMP     CMDIRTN  RETURN TO CMDI
```

```

1765 *-----*
1766 *      ECWGMG      GENERATE HC MODE MASKS FOR ECWSED      *
1767 *-----*
1768      F907      ECWGMG      EQU      *
1769 F907 C6 FC      LDA B      #-4
1770 F909 CE 108A      LDX      #HCMDRF
1771 F90C 3C      PSH X
1772 *-----*
1773 *      MAKE BADMASK OF HC'S COMMANDED BUT      *
1774 *      NOT RESPONDING      *
1775 *-----*
1776 F90D 6F 83      MSKLP1      CLR      $83,X      CLEAR BAD MASK
1777 F90F A6 3E      LDA A      $3E,X      HCMDMSK
1778 F911 AA 0A      ORA A      $0A,X      ACWMSK $1094
1779 F913 AA 17      ORA A      $17,X      BCWMSK $10A1
1780 F915 AA 24      ORA A      $24,X      CCWMSK $10AE
1781 F917 AA 31      ORA A      $31,X      DCWMSK $10BB
1782 F919 AB 51      EOR A      $51,X      CRMASK $10DB
1783 F91B AA 83      ORA A      $83,X      BADMASK $110D
1784 F91D A7 83      STA A      $83,X
1785 F91F 08      INX
1786 F920 5C      INC B
1787 F921 2B EA      BMI      MSKLP1      DO FOR 4 8-BIT MASK BYTES
1788 F923 38      PUL X
1789 F924 3C      PSH X
1790 F925 4F      CLR A
1791 F926 5F      CLR B
1792 F927 ED 3E      STD      $3E,X      CLEAR 32-BIT HC
1793 F929 ED 40      STD      $40,X      COMMAND MASK
1794 *-----*
1795 *      SET UP MASK BYTE FOR 4 HC'S      *
1796 *      POLLED THIS SECOND      *
1797 *-----*
1798 F92B 86 F0      LDA A      #$F0      LO-BYTE MASK
1799 F92D 06 8A      LDA B      $PNIM      HC# POLLED+4
1800 F92F C0 04      SUB B      #4
1801 F931 C4 1F      AND B      #$1F
1802 F933 D7 89      STA B      CTR      SAVE FOR MG1HC SUBRTN.
1803 F935 57      ASR B
1804 F936 57      ASR B      GET BYTE INDEX (0-3)
1805 F937 57      ASR B
1806 F938 25 02      RCR      CLRMSK      BRIF HI-NYBBLE
1807 F93A 86 0F      LDA A      #$0F

```



```

1809 *-----*
1810 *          CLEAR ALL MASK BITS FOR          *
1811 *          FOR 4 HC'S POLLED THIS SEC.      *
1812 *-----*
1813 F93C 38   CLRMSK  PUL X
1814 F93D 3C   PSH X
1815 F93E 3A   ABX          POINT TO BYTE IN MASK
1816 F93F 16   TAB
1817 F940 E4 73 AND B      $73,X      UPHCS MASK
1818 F942 E7 73 STA B      $73,X
1819 F944 16   TAB
1820 F945 E4 77 AND B      $77,X      DNHCS MASK
1821 F947 E7 77 STA B      $77,X
1822 F949 16   TAB
1823 F94A E4 7B AND B      $7B,X      WRDNHCS MASK
1824 F94C E7 7B STA B      $7B,X
1825 F94E 16   TAB
1826 F94F E4 7F AND B      $7F,X      HCPCS MASK
1827 F951 E7 7F STA B      $7F,X
1828 F953 16   TAB
1829 F954 E4 87 AND B      $87,X      WRUPHCS MASK
1830 F956 E7 87 STA B      $87,X
1831 *-----*
1832 *          GENERATE MODE MASKS FOR 4 HC'S   *
1833 *          FROM THEIR STATUS WORDS.        *
1834 *-----*
1835 F958 38   PUL X
1836 F959 EC 55 LDD          $55,X      HC# N+0 STATUS
1837 F95B 8D 2E BSR          MG1HC      MODE GEN FOR 1 HC
1838 F95D EC 58 LDD          $58,X      HC# N+1
1839 F95F 8D 2A BSR          MG1HC      MODE GEN
1840 F961 EC 61 LDD          $61,X      HC# N+2
1841 F963 8D 26 BSR          MG1HC
1842 F965 EC 67 LDD          $67,X      HC# N+3
1843 F967 8D 22 BSR          MG1HC

```

```

1845 *-----*
1846 *      DELETE ALL BAD HC'S FROM UPHCS,      *
1847 *      DNHCS & WRHCS MASKS.                *
1848 *-----*
1849 F969 C6 FC      LDA B      #-4
1850 F96B D7 8B      STA B      CTR      DO FOR 4 BYTES OF MASK
1851 F96D A6 83      MSKLP2    LDA A      $83,X    BADMASK
1852 F96F 43         COM A      BAD HC'S NOW 0 BITS
1853 F970 16         TAB
1854 F971 E4 73      AND B      $73,X    UPHCS MASK
1855 F973 E7 73      STA B      $73,X
1856 F975 16         TAB
1857 F976 E4 77      AND B      $77,X    DNHCS MASK
1858 F978 E7 77      STA B      $77,X
1859 F97A 16         TAB
1860 F97B E4 7B      AND B      $7B,X    WRDNHCS MASK
1861 F97D E7 7B      STA B      $7B,X
1862 F97F 16         TAB
1863 F980 E4 87      AND B      $87,X    WRUPHCS MASK
1864 F982 E7 87      STA B      $87,X
1865 F984 08         INX
1866 F985 7C 008B    INC      CTR
1867 F988 26 E3      BNE      MSKLP2    DO FOR 4 BYTES OF MASKS
1868 F98A 39         RTS      RETURN TO ECWOPS
1869 *
1870 *-----*
1871 *      MG1HC      SUBROUTINE SETS MODE BITS FOR 1 HC      *
1872 *      IN MASK ACCORDING TO HC STATUS.                *
1873 *-----*
1874 F98B          MG1HC      EQU      *
1875 F98B 3C         PSH X
1876 F98C 37         PSH B
1877 F98D 48         ASL A      POSITION POSN.CMPR. BIT
1878 F98E 48         ASL A      TO A-REG BIT-7
1879 F98F CE 1109    LDX      #HCPCS    ADDR OF MASK TO SET
1880 F992 8D 52      BSR      SETMSK    SET MASK TO A-REG BIT-7

```

```

1882 *-----*
1883 *          PUT MASK ADDR FOR STATUS IN          *
1884 *          XREG THE GOTO 'DOMODE'              *
1885 *-----*
1886 F994 33          PUL B
1887 F995 C4 7C      AND B          #$7C          ISOLATE MODE/SUBMODE
1888 F997 CE 10FD     LDX          #UPHCS
1889 F99A C1 20      CMP B          #$20
1890 F99C 27 3F      BEQ          DOMODE          BRIF BP/RCVR
1891 F99E C1 24      CMP B          #$24
1892 F9A0 27 38      BEQ          DOMODE          BRIF BP/ALT1
1893 F9A2 C1 28      CMP B          #$28
1894 F9A4 27 37      BEQ          DOMODE          BRIF BP/ALT2
1895 F9A6 C1 2C      CMP B          #$2C
1896 F9A8 27 33      BEQ          DOMODE          BRIF BP/RCS
1897 F9AA C1 30      CMP B          #$30
1898 F9AC 27 2F      BEQ          DOMODE          BRIF BP/CULP
1899 *
1900 F9AE CE 1101     LDX          #DNHCS
1901 F9B1 C1 34      CMP B          #$34
1902 F9B3 27 28      BEQ          DOMODE          BRIF BP/CLLP
1903 *
1904 F9B5 CE 1105     LDX          #WRDNHCS
1905 F9B8 C1 44      CMP B          #$44
1906 F9BA 27 21      BEQ          DOMODE          BRIF CW-DN=A
1907 F9BC C1 4C      CMP B          #$4C
1908 F9BE 27 1D      BEQ          DOMODE          BRIF CW-DN=B
1909 F9C0 C1 54      CMP B          #$54
1910 F9C2 27 19      BEQ          DOMODE          BRIF CW-DN=C
1911 F9C4 C1 5C      CMP B          #$5C
1912 F9C6 27 15      BEQ          DOMODE          BRIF CW-DN=D
1913 *
1914 F9C8 CE 1111     LDX          #WRUPHCS
1915 F9CB C1 40      CMP B          #$40
1916 F9CD 27 0E      BEQ          DOMODE          BRIF CW-UP=A
1917 F9CF C1 48      CMP B          #$48
1918 F9D1 27 0A      BEQ          DOMODE          BRIF CW-UP=B
1919 F9D3 C1 50      CMP B          #$50
1920 F9D5 27 06      BEQ          DOMODE          BRIF CW-UP=C
1921 F9D7 C1 58      CMP B          #$58
1922 F9D9 27 02      BEQ          DOMODE          BRIF CW-UP=D
1923 F9DB 20 04      BRA          MG1RTN
1924 *
1925 F9DD 86 FF      DOMODE LDA A          #$FF          SET BIT ON
1926 F9DF 8D 05      BSR          SETMSK          SET BIT FOR THIS HC VIA X-REG
1927 *
1928 F9E1 7C 008B     MG1RTN INC          CTR          INCR TO NEXT HC#
1929 F9E4 38          PUL X
1930 F9E5 39          RTS          RETURN TO ECWMG

```

```

1932 *-----*
1933 *          SET A-REG BIT-7 INTO BYTE POINTED          *
1934 *          TO BY X-REG                                  *
1935 *-----*
1936 F9E6 84 80 SETMSK AND A      #80
1937 F9E8 36      PSH A
1938 F9E9 96 8B      LDA A      CTR      GET HC#
1939 F9EB 16      TAB
1940 F9EC 84 07      AND A      #7      ISOLATE BIT WITHIN BYTE
1941 F9EE 57      ASR B
1942 F9EF 57      ASR B      GET BYTE OFFSEST
1943 F9F0 57      ASR B
1944 F9F1 3A      ARX
1945 F9F2 33      PUL B      POINT X-REG
1946 F9F3 58      ASL B      THE BIT
1947 F9F4 56      STMSK1 ROR B      PUT IN CARRY
1948 F9F5 4A      DEC A
1949 F9F6 2A FC      BPL      STMSK1      SHIFT BIT TO CORRECT POSN
1950 F9F8 EA 00      ORA B      0,X      'OR' INTO MASK
1951 F9FA E7 00      STA B      0,X
1952 F9FC 39      RTS      RETURN TO CALLER

```

| | | | | | | | | | |
|------|------|---------|---------|-------|---|---------|-------|---------------------------------|---|
| 1954 | | | | | | | | | |
| 1955 | | | | | | | | | |
| 1956 | | | | | | | | | |
| 1957 | | | | | | | | | |
| 1958 | F9FD | | ECWSEQ | EQU | * | | PHASE | DESCRIPTION | |
| 1959 | F9FD | D6 94 | | LDA B | | ECWPHZ | | CURRENT OPS PHASE | |
| 1960 | F9FF | C1 13 | | CMP B | | #19 | | | |
| 1961 | FA01 | 2E 0A | | BGT | | ESQERR | | BRIF INVALID PHASE | |
| 1962 | FA03 | 58 | | ASL B | | | | *2 | |
| 1963 | FA04 | CE FA10 | | LDX | | #ECWTBL | | PHASE ROUTINE ADDRESSES | |
| 1964 | FA07 | 3A | | ABX | | | | | |
| 1965 | FA08 | EE 00 | | LDX | | 0,X | | GET ROUTINE ADR | |
| 1966 | FA0A | AD 00 | | JSR | | 0,X | | DOIT | |
| 1967 | FA0C | 39 | | RTS | | | | | |
| 1968 | | | * | | | | | | |
| 1969 | FA0D | | ESQERR | EQU | * | | | SEQUENCE ERROR | |
| 1970 | FA0D | | ECWST19 | EQU | * | | | ECW DONE | |
| 1971 | FA0D | 0F | | SEI | | | | | |
| 1972 | FA0E | 20 FD | | BRA | | ECWST19 | | STALL TILL DMT RESTART | |
| 1973 | | | * | | | | | | |
| 1974 | | | * | | | | | | |
| 1975 | | | * | | | | | ECW PHASE ROUTINE ADDRESS TABLE | * |
| 1976 | | | * | | | | | | |
| 1977 | | | * | | | | | | |
| 1978 | FA10 | | ECWTBL | EQU | * | | PHASE | DESCRIPTION | |
| 1979 | | | * | | | | | | |
| 1980 | FA10 | FA38 | | FDB | | ECWST0 | 0 | = SET-UP 8 SEC WAIT | |
| 1981 | FA12 | FA41 | | FDB | | ECWST1 | 1 | = CMD ACULP | |
| 1982 | FA14 | FA68 | | FDB | | ECWST2 | 2 | = CMD BCULP | |
| 1983 | FA16 | FA78 | | FDB | | ECWST3 | 3 | = CMD CCULP | |
| 1984 | FA18 | FA8B | | FDB | | ECWST4 | 4 | = CMD DCULP | |
| 1985 | FA1A | FA98 | | FDB | | ECWST5 | 5 | = CMD CLLPS TO STOW | |
| 1986 | FA1C | FAA5 | | FDB | | ECWST6 | 6 | = WAIT 7 MINUTES | |
| 1987 | FA1E | FAAE | | FDB | | ECWST7 | 7 | = CMD A CW-UP TO ACULP | |
| 1988 | FA20 | FAC2 | | FDB | | ECWST8 | 8 | = CMD B CW-UP TO BCULP | |
| 1989 | FA22 | FAD3 | | FDB | | ECWST9 | 9 | = CMD C CW-UP TO CCULP | |
| 1990 | FA24 | FAE4 | | FDB | | ECWST10 | 10 | = CMD D CW-UP TO DCULP | |
| 1991 | FA26 | FAFA | | FDB | | ECWST11 | 11 | = WAIT 10 SEC & CMD CW-DN=A | |
| 1992 | FA28 | FB17 | | FDB | | ECWST12 | 12 | = CMD CW-DN=B | |
| 1993 | FA2A | FB31 | | FDB | | ECWST13 | 13 | = CMD CW-DN=C | |
| 1994 | FA2C | FB4B | | FDB | | ECWST14 | 14 | = CMD CW-DN=D | |
| 1995 | FA2E | FB69 | | FDB | | ECWST15 | 15 | = WAIT 10 SEC & CMD CLLPS S | |
| 1996 | FA30 | FAA5 | | FDB | | ECWST16 | 16 | = WAIT 7 MINUTES | |
| 1997 | FA32 | FB77 | | FDB | | ECWST17 | 17 | = CMD CLLPS STOW | |
| 1998 | FA34 | FB89 | | FDB | | ECWST18 | 18 | = WAIT 11 MINS FOR STOW CMP | |
| 1999 | FA36 | FA0D | | FDB | | ECWST19 | 19 | = WAIT FOR WATCH-DOG RESET | |
| 2000 | | | * | | | | | | |

```

2002 *****
2003 * EMERGENCY OPERATIONAL PHASES *
2004 *****
2005 FA38 CE 0008 ECWST0 LDX #8
2006 FA38 DF 95 STX ECWTMR SET 8 SEC. DELAY
2007 FA3D 7C 0094 INC ECWPHZ ADVANCE PHASE
2008 FA40 39 RTS RETURN TO ECWSEQ
2009 *
2010 FA41 BD FB8F ECWST1 JSR CKTMOT SEE IF ECWTMR EXPIRED
2011 * ;ELSE DON'T RETURN HERE
2012 FA44 4F CLR A
2013 FA45 97 8C STA A HACENA DISABLE HAC INPUT
2014 *****
2015 * COMMAND ANY HELIOSTATS ON TARGET *
2016 * TO CULP A B C AND D *
2017 *****
2018 FA47 CE 10C8 LDX #HCMDMSK
2019 FA4A DF 8F STX TEMP
2020 FA4C CE 1115 LDX #CORAAS GET A CORR MASK
2021 FA4F BD FB0D JSR TXCWMSK MOVE/MASK UPHCS-A TO HCMDMSK
2022 FA52 CE 1003 LDX #ACULP=1 MOVE FROM ADDRESS
2023 FA55 DF 8D CMDULP STX FROM
2024 FA57 CE 10D0 LDX #BPX MOVE TO ADDRESS
2025 FA5A C6 F7 LDA B #-9 MOVE 9 BYTES
2026 FA5C BD F51B JSR MOVE MOVE A OR B CULP TO CMD
2027 FA5F 86 2C LDA A #$2C BP//CULP
2028 FA61 B7 108A STA A HCMD8F
2029 FA64 BD F3FB JSR XTRACT REMOVE FROM CW MASKS
2030 FA67 7C 0094 INC ECWPHZ ADVANCE PHASE
2031 FA6A 39 RTS RETURN TO ECWOPS

```

| | | | | | | | |
|------|------|------|------|---------|-----|----------|------------------------------|
| 2033 | | | * | | | | |
| 2034 | FA6B | CE | 10CB | ECWST2 | LDX | #HCMDMSK | |
| 2035 | FA6E | DF | 8F | | STX | TEMP | |
| 2036 | FA70 | CE | 1119 | | LDX | #CORABS | SELECT UPHCS=8 |
| 2037 | FA73 | BD | FBCD | | JSR | TXCWMSK | MOVE/MASK UPHCS=8 TO HCMDMSK |
| 2038 | FA76 | CE | 1010 | | LDX | #BCULP=1 | |
| 2039 | FA79 | 20 | DA | | BRA | CMDULP | SET CULP COMMAND |
| 2040 | | | | * | | | |
| 2041 | FA7B | CE | 10CB | ECWST3 | LDX | #HCMDMSK | |
| 2042 | FA7E | DF | 8F | | STX | TEMP | |
| 2043 | FA80 | CE | 111D | | LDX | #CORACS | |
| 2044 | FA83 | BD | FBCD | | JSR | TXCWMSK | |
| 2045 | FA86 | CE | 1046 | | LDX | #CCULP=1 | |
| 2046 | FA89 | 20 | CA | | BRA | CMDULP | |
| 2047 | | | | * | | | |
| 2048 | FA8B | CE | 10CB | ECWST4 | LDX | #HCMDMSK | |
| 2049 | FA8E | DF | 8F | | STX | TEMP | |
| 2050 | FA90 | CE | 1121 | | LDX | #CORADS | |
| 2051 | FA93 | BD | FBCD | | JSR | TXCWMSK | |
| 2052 | FA96 | CE | 1053 | | LDX | #DCULP=1 | |
| 2053 | FA99 | 20 | BA | | BRA | CMDULP | |
| 2054 | | | | * | | | |
| 2055 | FA9B | CE | 108A | ECWST5 | LDX | #HCMDDBF | |
| 2056 | FA9E | BD | FBA0 | | JSR | DN2STO | COMMAND DNHCS TO STOW |
| 2057 | FAA1 | 7C | 0094 | | INC | ECWPHZ | ADVANCE PHASE |
| 2058 | FAA4 | 39 | | | RTS | | RETURN TO ECWSEQ |
| 2059 | | | | * | | | |
| 2060 | | FAA5 | | ECWST6 | EQU | * | |
| 2061 | | FAA5 | | ECWST16 | EQU | * | |
| 2062 | FAA5 | CE | 01A4 | | LDX | #420 | |
| 2063 | FAA8 | DF | 95 | | STX | ECWTMR | SET 7 MIN. DELAY |
| 2064 | FAAA | 7C | 0094 | | INC | ECWPHZ | ADVANCE PHASE |
| 2065 | FAAD | 39 | | | RTS | | RETURN TO ECWSEQ |

```
2067 FAAE BD FB8F ECWST7 JSR      CKTMOT
2068 FAR1 CE 10C8          LDX      #HCMDMSK
2069 FAB4 DF 8F           STX      TEMP
2070 FAB6 CE 1115          LDX      #CORAAAS
2071 FAB9 BD FBF1          JSR      TXUPMSK
2072 FABC CE 1003          LDX      #ACULP-1
2073 FABF 7E FA55          JMP      CMDULP
2074
2075 FAC2 CE 10C8 *        LDX      #HCMDMSK
2076 FAC5 DF 8F           STX      TEMP
2077 FAC7 CE 1119          LDX      #CORABS
2078 FACA BD FBF1          JSR      TXUPMSK
2079 FACD CE 1010          LDX      #BCULP-1
2080 FAD0 7E FA55          JMP      CMDULP
2081
2082 FAD3 CE 10C8 *        LDX      #HCMDMSK
2083 FAD6 DF 8F           STX      TEMP
2084 FAD8 CE 111D          LDX      #CORACS
2085 FADB BD FBF1          JSR      TXUPMSK
2086 FADE CE 1046          LDX      #CCULP-1
2087 FAE1 7E FA55          JMP      CMDULP
2088
2089 FAE4 CE 10C8 *        LDX      #HCMDMSK
2090 FAE7 DF 8F           STX      TEMP
2091 FAE9 CE 1121          LDX      #CORADS
2092 FAEC BD FBF1          JSR      TXUPMSK
2093 FAEF CE 000A          LDX      #10
2094 FAF2 DF 95           STX      ECWTMR
2095 FAF4 CE 1053          LDX      #DCULP-1
2096 FAF7 7E FA55          JMP      CMDULP
```



```
2098 *
2099 FAFA 8D FB8F ECWST11 JSR CKTMOT SEE IF ECWTMR EXPIRED
2100 FAFD CE 108A LDX #HCMDBF
2101 FB00 8D FB88 JSR DLTNPCS DELETE HCS W/O POSN. CMPR.
2102 FB03 CE 009B LDX #HACIBF+2 POINT TO CW SELECT MASK
2103 FB06 DF 8F STX TEMP IN HAC INPUT BUFFER
2104 FB08 CE 1115 LDX #CORAA5
2105 FB0B 8D FB8D JSR TXCWMSK MOVE/MASK UPHCS-A TO HAC
2106 * INPUT BUFFER
2107 FB0E 86 11 LDA A #$11 MAKE CW A COMMAND BYTE
2108 FB10 8D F45F JSR CMDCW COMMAND CW=A START
2109 FB13 7C 0094 INC ECWPHZ ADVANCE PHASE
2110 FB16 39 RTS RETURN TO ECWSEQ
2111 *
2112 FB17 CE 108A ECWST12 LDX #HCMDBF
2113 FB1A 8D FB88 JSR DLTNPCS DELETE HC'S W/O POSN. CMPR
2114 * FROM COMMAND MASKS
2115 FB1D CE 009B LDX #HACIBF+2 POINT TO CW SELECT MASK
2116 FB20 DF 8F STX TEMP IN HAC INPUT BUFFER
2117 FB22 CE 1119 LDX #CORABS SET SELECT CW B HC'S
2118 FB25 8D FB8D JSR TXCWMSK MOVE/MASK UP-B HCS TO HAC
2119 * INPUT BUFFER
2120 FB28 86 13 LDA A #$13 MAKE CW-B COMMAND BYTE
2121 FB2A 8D F45F JSR CMDCW COMMAND CW=B START
2122 FB2D 7C 0094 INC ECWPHZ ADVANCE PHASE
2123 FB30 39 RTS RETURN TO ECWSEQ
```

```
2125 *
2126 FB31 CE 108A ECWST13 LDX #HCMDBF
2127 FB34 BD FB88 JSR DLTNPCS DELETE HCS W/O POSN. CMPR.
2128 FB37 CE 009B LDX #HACIBF+2 POINT TO CW SELECT MASK
2129 FB3A DF 8F STX TEMP IN HAC INPUT BUFFER
2130 FB3C CE 111D LDX #CORACS SET SELECT UP-C HCS
2131 FB3F BD FB0D JSR TXCWMSK MOVE/MASK UPHCS-C TO HAC
2132 *
2133 FB42 86 15 LDA A #S15 MAKE CW C COMMAND BYTE
2134 FB44 BD F45F JSR CMDCW COMMAND CW-C START
2135 FB47 7C 0094 INC ECWPHZ ADVANCE PHASE
2136 FB4A 39 RTS RETURN TO ECWSEQ
2137 *
2138 FB48 CE 108A ECWST14 LDX #HCMDBF
2139 FB4E 8D 68 BSR DLTNPCS DELETE HC'S W/O POSN. CMPR
2140 * FROM COMMAND MASKS
2141 FB50 CE 009B LDX #HACIBF+2 POINT TO CW SELECT MASK
2142 FB53 DF 8F STX TEMP IN HAC INPUT BUFFER
2143 FB55 CE 1121 LDX #CORADS SET SELECT CW D HC'S
2144 FB58 BD FB0D JSR TXCWMSK MOVE/MASK UP-D HCS TO HAC
2145 * INPUT BUFFER
2146 FB5B 86 17 LDA A #S17 MAKE CW-D COMMAND BYTE
2147 FB5D BD F45F JSR CMDCW COMMAND CW-D START
2148 FB60 CE 000A LDX #10 SET COUNT OF 10
2149 FB63 DF 95 STX ECWTMR TO INSURE HC START MOVING
2150 FB65 7C 0094 INC ECWPHZ ADVANCE PHASE
2151 FB68 39 RTS RETURN TO ECWSEQ
```

| | | | | | | | |
|------|------|----|------|---------|-----|---------|---|
| 2153 | | | * | | | | |
| 2154 | FB69 | BD | FB8F | ECWST15 | JSR | CKTMOT | RTN IF 10 SEC WAIT EXPIRED |
| 2155 | FB6C | CE | 108A | | LDX | #HCMDBF | |
| 2156 | FB6F | BD | 47 | | BSR | DLTNPCS | DELETE HCS W/O POSN CMPR FROM COMMAND MASKS |
| 2157 | | | * | | | | |
| 2158 | FB71 | BD | 25 | | BSR | WR2STO | COMMAND CLLP HCS TO STOW |
| 2159 | | | * | | | | |
| 2160 | FB73 | 7C | 0094 | | INC | ECWPHZ | ADVANCE PHASE |
| 2161 | FB76 | 39 | | | RTS | | RETURN TO ECWSEQ |
| 2162 | | | * | | | | |
| 2163 | FB77 | BD | 16 | ECWST17 | BSR | CKTMOT | CHECK IF ECWTMR EXPIRED ELSE DON'T RETURN HERE |
| 2164 | | | * | | | | |
| 2165 | FB79 | CE | 108A | | LDX | #HCMDBF | |
| 2166 | FB7C | BD | 3A | | BSR | DLTNPCS | DELETE HCS W/O POSN CMPR FROM COMMAND MASKS |
| 2167 | | | * | | | | |
| 2168 | FB7E | BD | 18 | | BSR | WR2STO | COMMAND CLLP HCS TO STOW |
| 2169 | FB80 | 7C | 0094 | | INC | ECWPHZ | ADVANCE PHASE |
| 2170 | FB83 | CE | 0294 | | LDX | #660 | 11 MINS. |
| 2171 | FB86 | DF | 95 | | STX | ECWTMR | ALLOW TIME TO STOW |
| 2172 | FB88 | 39 | | | RTS | | RETURN TO ECWSEQ |
| 2173 | | | * | | | | |
| 2174 | FB89 | BD | 04 | ECWST18 | BSR | CKTMOT | CHECK TI ECWTMR EXPIRED ELSE DON'T RETURN HERE |
| 2175 | | | * | | | | |
| 2176 | FB8B | 7C | 0094 | | INC | ECWPHZ | ADVANCE PHASE |
| 2177 | FB8E | 39 | | | RTS | | RETURN TO ECWSEQ |

```

2179 *-----*
2180 *          ECWSED SUBROUTINES          *
2181 *-----*
2182 FB8F DE 95   CKTMOT   LDX           ECWTMR
2183 FB91 09           DEX
2184 FB92 27 03           BEQ           TMOT           RETURN TO ECWSTX SUBR.
2185 FB94 DF 95           STX           ECWTMR
2186 FB96 38           PUL X          (SP++)        FORCE RETURN TO ECWSED
2187 FB97 39           TMOT           RTS
2188 *
2189 FB98 EC 78   WR2STO   LDD           $78,X        WRDNHCS
2190 FB9A ED 77           STD           $77,X        DNHCS
2191 FB9C EC 7D           LDD           $7D,X        WRDNHCS+2
2192 FB9E ED 79           STD           $79,X        DNHCS+2
2193 *
2194 FBA0 86 78   DN2STO   LDA A          #$78           STOW COMMAND
2195 FBA2 A7 00           STA A          $00,X        HCMDBF
2196 FBA4 EC 77           LDD           $77,X        DNHCS MASK
2197 FBA6 ED 3E           STD           $3E,X        HCMDSK
2198 FBA8 EC 79           LDD           $79,X
2199 FBAA ED 40           STD           $40,X
2200 FBAC 4F           CLR A
2201 FBAD 5F           CLR B
2202 FBAE ED 42           STD           $42,X        CMDAZ
2203 FBB0 86 E0           LDA A          #$E0
2204 FBB2 ED 44           STD           $44,X        CMDEL
2205 FBB4 BD F3FB        JSR           XTRACT        REMOVE FROM CW MASKS
2206 FBB7 39           RTS
2207 *
2208 FBB8 3C           DLTNPCS   PSH X
2209 FBB9 C6 FC           LDA B          #-4           DO FOUR TIMES
2210 *
2211 FBBB A6 7F   DLTNPL   LDA A          $7F,X        HCPCS MASK
2212 FBBD A4 73           AND A          $73,X        UPHCS MASK
2213 FBBF A7 73           STA A          $73,X
2214 FBC1 A6 7F   DLTNPL   LDA A          $7F,X        HCPCS MASK
2215 FBC3 A4 7B           AND A          $7B,X        WRDNHCS MASK
2216 FBC5 A7 7B           STA A          $7B,X
2217 FBC7 08           INX
2218 FBC8 5C           INC B
2219 FBC9 2B F0           BMI           DLTNPL        DO 4 BYTE MASK
2220 *
2221 FBCB 38           PUL X
2222 FBCC 39           RTS

```


| | | | | | | | | | |
|------|------|----|------|----------|-----|---|-----------|--------------------|--|
| 2246 | FBF1 | B6 | 1111 | TXUPMSK | LDA | A | WRUPHCS | | |
| 2247 | FBF4 | A4 | 00 | | AND | A | 0,X | | |
| 2248 | FBF6 | 36 | | | PSH | A | | | |
| 2249 | FBF7 | B6 | 1112 | | LDA | A | WRUPHCS+1 | | |
| 2250 | FBFA | A4 | 01 | | AND | A | 1,X | | |
| 2251 | FBFC | 36 | | | PSH | A | | | |
| 2252 | FBFD | B6 | 1113 | | LDA | A | WRUPHCS+2 | | |
| 2253 | FC00 | A4 | 02 | | AND | A | 2,X | | |
| 2254 | FC02 | 36 | | | PSH | A | | | |
| 2255 | FC03 | B6 | 1114 | | LDA | A | WRUPHCS+3 | | |
| 2256 | FC06 | A4 | 03 | | AND | A | 3,X | | |
| 2257 | FC08 | 36 | | | PSH | A | | | |
| 2258 | FC09 | C6 | FC | | LDA | B | #=4 | | |
| 2259 | FC0B | DE | 8F | | LDX | | TEMP | WHERE RESULT GOES | |
| 2260 | FC0D | 32 | | TXUPLoop | PUL | A | | | |
| 2261 | FC0E | A7 | 03 | | STA | A | 3,X | LAST BYTE FIRST | |
| 2262 | FC10 | 09 | | | DEX | | | | |
| 2263 | FC11 | 5C | | | INC | B | | | |
| 2264 | FC12 | 2B | F9 | | BMI | | TXUPLoop | DO FOR 4 BYTE MASK | |
| 2265 | FC14 | 39 | | | RTS | | | | |
| 2266 | | | | | END | | | | |

*SYMBOL TABLE

| | | | | | | | | | |
|----------|------|----------|------|----------|------|----------|------|----------|------|
| ACLLP | 101A | ACRST | F0C7 | ACULP | 1004 | ACWFLG | 1039 | ACWHC | F768 |
| ACWMSK | 1094 | ACWTX | 1098 | ACWTY | 109B | ACWTZ | 109E | ADELTA | 1030 |
| AHACSR | 6000 | ALTBUS | 1002 | BADHCS | 110D | BCLLP | 1027 | BCULP | 1011 |
| BCWFLG | 1046 | BCWHC | F778 | BCWMSK | 10A1 | BCWTX | 10A5 | BCWTY | 10A8 |
| BCWTZ | 10AB | BDELTA | 103D | BHACSR | 3000 | BPX | 10D0 | BPY | 10D3 |
| BPZ | 10D6 | BUSTMR | 1125 | BUSWAP | F160 | BUSW1 | F180 | BUSW2 | F17E |
| CCLLP | 105D | CCULP | 1047 | CCWFLG | 107C | CCWHC | F785 | CCWMOV | F45A |
| CCWMSK | 10AE | CCWTX | 1082 | CCWTY | 1085 | CCWTZ | 1088 | CDELTA | 1073 |
| CKCKSM | F2D3 | CKCWA | F78A | CKDELTA | F812 | CKDELTC | F883 | CKDNNDAB | F83E |
| CKDNND | F8AF | CKDTMR | F00F | CKHFN | F2C0 | CKSVTM | F1F7 | CKTMOT | F88F |
| CKUPNDAB | F833 | CKUPND | F8A4 | CKWNB | F7CD | CKWNC | F7DE | CKWWD | F7F7 |
| CLRCRM | F676 | CLRMSK | F93C | CMABFN | F488 | CMCWD | F478 | CMCWBD | F4A4 |
| CMCWBU | F48E | CMCWCD | F4D0 | CMCWCU | F48A | CMCWDD | F4FC | CMCWDU | F4E6 |
| CMCWER | F512 | CMDAE | F3E6 | CMDAZ | 10CC | CMDBP | F3C7 | CMDBP2 | F3CA |
| CMDCMD | F39A | CMDCMD1 | F3AD | CMDCW | F45F | CMDEL | 10CE | CMDEP | F259 |
| CMDHICIN | F3B1 | CMOIN | F213 | CMDINI | F52F | CMDIRTN | F267 | CMOI | F1E4 |
| CMDS1 | F378 | CMDS4 | F362 | CMDULP | FA55 | COMASK | 0091 | CORAAS | 1115 |
| CORABS | 1119 | CORACS | 111D | CORADS | 1121 | CORAS | F58F | CRL00P | F6A7 |
| CRMASK | 10DB | CRNONE | F6E8 | CRRW1 | F686 | CRRW2 | F68E | CSR | 0000 |
| CTR | 008B | CWCALC | F785 | CWCENDAB | F81E | CWCENDCD | F88F | CWDNAB | F820 |
| CWDNCD | F891 | CWIDLE | F80B | CWSTOPAB | F828 | CWSTOPCD | F899 | CWTYPE | 0097 |
| CWUPAB | F818 | CWUPCD | F889 | DCLLP | 106A | DCULP | 1054 | DCWFLG | 1089 |
| DCWHC | F792 | DCWMSK | 108B | DCWTX | 10BF | DCWTY | 10C2 | DCWTZ | 10C5 |
| DDELTA | 1080 | DDNLPAR | F868 | DDNLPCD | F8DC | DELTDNAB | F866 | DELTDNCD | F8D7 |
| DELTUPAB | F849 | DELTUPCD | F88A | DLTNPCS | F8B8 | DLTNPL | F8BB | DLTYMR | 0081 |

| C00 13:24 JAN 27, '84 | | | MMC M6801/M6803 MPU ASSEMBLER | | | | | PAGE 71 | |
|-----------------------|------|----------|-------------------------------|----------|------|----------|------|---------|------|
| DNHCS | 1101 | DN2STO | F8A0 | DOHCOP | F293 | DOMODE | F90D | DUPLPAB | F84E |
| DUPLPCD | F8BF | ECWFLG | 0093 | ECWHI | F299 | ECWNG | F907 | ECWOPS | F8F4 |
| ECWPHZ | 0094 | ECWSEQ | F9FD | ECWSTO | F293 | ECWST0 | FA38 | ECWST1 | FA41 |
| ECWST10 | FAE4 | ECWST11 | FAFA | ECWST12 | FB17 | ECWST13 | FB31 | ECWST14 | FB4B |
| ECWST15 | FB69 | ECWST16 | FAA5 | ECWST17 | FB77 | ECWST18 | FB89 | ECWST19 | FA0D |
| ECWST2 | FA6B | ECWST3 | FA7B | ECWST4 | FA8B | ECWST5 | FA9B | ECWST6 | FAA5 |
| ECWST7 | FAAF | ECWST8 | FAC2 | ECWST9 | FAD3 | ECWTBL | FA10 | ECWTMR | 0095 |
| ESQERR | FA0D | FROM | 008D | GET2ND | F2B9 | GODNA | F487 | GODNA1 | F48A |
| GODNB | F4B3 | GODNB1 | F4B6 | GODNC | F4DF | GODNC1 | F4E2 | GODND | F50B |
| GODND1 | F50E | GOUPA | F471 | GOUPA1 | F474 | GOUPB | F49D | GOUPB1 | F4A0 |
| GOUPC | F4C9 | GOUPC1 | F4CC | GOUPD | F4F5 | GOUPD1 | F4F8 | HACDUN | F0DA |
| HACENA | 008C | HACIBF | 0099 | HACIN | F0E6 | HACIOI | F0B5 | HACIP | F0CC |
| HACIST | 0089 | HACI | F0C1 | HACKSM | F118 | HACOP | F0D1 | HACOUT | F104 |
| HACRD | F142 | HACSTAT | 10D9 | HACWRT | F11D | HACWT1 | F135 | HACWT2 | F139 |
| HAINST | F0FC | HCIBUF | 0099 | HCINST | F042 | HCIN | F02C | HCIOI | F01F |
| HCIST | 0088 | HCMDBF | 108A | HCMDSK | 10C8 | HCOCKS | F05D | HCOCRR | F67F |
| HCODUN | F066 | HCOPOL | F6E9 | HCOPS | F603 | HCOSSC | F615 | HCOUT | F04A |
| HCOXIT | F062 | HPCPS | 1109 | HCPERR | F750 | HCPGOOD | F756 | HCPLP | F703 |
| HCPWAT | F707 | HCRD | F072 | HCRVRS | F5F2 | HCWAT1 | F0AC | HCWAT2 | F0B0 |
| HCWRT | F093 | HFCINZ | F18C | HFCMRTN | 10F9 | HFCRAM | 1000 | HFCSTK | 00FF |
| HFMODE | 10FA | HFSTAT | 10F7 | ICLAB | F54E | ICLCD | F575 | ICUAB | F53F |
| ICUCD | F568 | IDLE | F1EF | IDTAB | F55B | IDTCD | F582 | INZERR | F5CE |
| INZMOV | F5A9 | INZMV3 | F5CA | INZPHZ | 0092 | INZ00 | F191 | IOCKSM | 0086 |
| IOERR | F25C | IOTA | 0083 | IOTC | 0085 | IOTMR | 0080 | IOWAIT | 0087 |
| JCMDI | F264 | JCRTN | F33E | KILLSB | F41E | LENTAB | F2EC | MG1HC | F98B |
| MG1RTN | F9E1 | MOVCWA | F62A | MOVCWB | F637 | MOVCWC | F642 | MOVCWD | F64D |
| MOVE | F51B | MSKBIT | F7A3 | MSKLP1 | F90D | MSKLP2 | F96D | MVLOOP | F522 |
| MVMSK | F652 | NGRP0 | F6C7 | NGRP1 | F6D0 | NGRP2 | F6D9 | NGRP3 | F6E2 |
| NOECW | F901 | NOHCWW | F7A1 | NOSUN | F2AB | NOTINZ | F30C | NOTSTAT | F32F |
| NOTST4 | F326 | NOTSUN | F31B | NRMHI | F2FC | NRMSTO | F286 | OKCMD | F338 |
| PCKILL | F79B | POL1HC | F71A | PRIBUS | 1000 | P1DATA | 0002 | P1DD | 0000 |
| P2DATA | 0003 | P2DD | 0001 | P2WAT | F730 | P3CSR | 000F | P3DATA | 0006 |
| P3DD | 0004 | P4DATA | 0007 | P4DD | 0005 | RAMCR | 0014 | RDR | 0001 |
| REENTR | F22F | REENTR1 | F244 | REENTR2 | F24D | REENTR3 | F253 | RSTHI | F299 |
| RSTSTO | F26F | RSTSTS | F27C | RVRS3 | F5DE | RVRS9 | F5DC | SCREEN | F765 |
| SETMSK | F9E6 | SI0CSR | 0011 | STORDR | 0012 | SIORMR | 0010 | SIOTDR | 0013 |
| SPNUM | 008A | SPOLBF | 009A | SSCNCW | F668 | STALL | F53C | STKLIM | 00BC |
| STMSK1 | F9F4 | STOPCWAB | F82A | STOPCWCD | F89B | STXTL | F440 | STXT | F42E |
| SUNTMR | 0082 | SX | 108B | SY | 108E | SZ | 1091 | TDR | 0001 |
| TEMP | 008F | TICHI | 000D | TICLO | 000E | TMOT | F897 | TMRCR | 0008 |
| TMRHI | 0009 | TMRLO | 000A | TOC | F000 | TOCHI | 000B | TOCLO | 000C |
| TOF | F017 | TXCWLOOP | FBE9 | TXCWMSK | FBCD | TXUPLOOP | FC0D | TXUPMSK | FBF1 |
| UPHCS | 10FD | VALCMD | F2AE | WATBUS | F187 | WATONE | F182 | WDTRST | F2C8 |
| WRDNHCS | 1105 | WRUPHCS | 1111 | WR2STO | FB98 | XFRSUN | F342 | XITOC | F016 |
| XTRACT | F3FB | XTRLP | F400 | YESSUN | F313 | | | | |

*NO UNDEFINED SYMBOLS

*NO ERROR LINES

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|--------|--------------------------|
| 123 | ACLLP | 994 1136 |
| 371 | ACRST | 366 |
| 120 | ACULP | 1005 1130 1523 2022 2072 |
| 127 | ACWFLG | |
| 1457 | ACWHC | |
| 148 | ACWMSK | 948 1266 1459 |
| 149 | ACWTX | 992 1003 |
| 150 | ACWTY | |
| 151 | ACWTZ | |
| 126 | ADELTA | 1142 |
| 67 | AHACSR | 520 |
| 117 | ALTBUS | 365 485 488 525 |
| 199 | BADHCS | 554 555 |
| 125 | BCLLP | 1019 |
| 122 | BCULP | 1030 1535 2038 2079 |
| 129 | BCWFLG | |
| 1464 | BCWHC | 1458 |
| 152 | BCWMSK | 1272 1466 |
| 153 | BCWTX | 1017 1028 |
| 154 | BCWTY | |
| 155 | BCWTZ | |
| 128 | BDELTA | |
| 69 | BHACSR | 521 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|----------|--------------------------|
| 167 | BPX | 888 1290 2024 |
| 168 | BPY | |
| 169 | BPZ | |
| 207 | BUSTMR | 541 650 654 |
| 482 | BUSWAP | 652 668 |
| 498 | BUSW1 | 496 |
| 497 | BUSW2 | 494 |
| 133 | CCLLP | 1044 1154 |
| 130 | CCULP | 1055 1148 1548 2045 2086 |
| 137 | CCWFLG | |
| 1471 | CCWHC | 1465 |
| 983 | CCWMOV | 996 1007 1021 1032 |
| 156 | CCWMSK | 1278 1473 |
| 157 | CCWTX | 1042 1053 |
| 158 | CCWTY | |
| 159 | CCWTZ | |
| 136 | CDELTA | 1160 |
| 726 | CKCKSM | 712 |
| 1521 | CKCWA | |
| 1580 | CKDELTAB | 1527 1537 |
| 1666 | CKDELTCO | 1556 1569 |
| 1609 | CKDNNDAB | 1591 |
| 1695 | CKDNNDOD | 1677 |
| 236 | CKDTMR | 233 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|----------|-------------------------------|
| 710 | CKHFN | 703 |
| 573 | CKSVTM | 570 |
| 2182 | CKTMOT | 2010 2067 2099 2154 2163 2174 |
| 1602 | CKUPNDAB | 1585 |
| 1688 | CKUPNDCD | 1671 |
| 1533 | CKWNB | 1522 1529 |
| 1546 | CKWNC | 1534 1539 |
| 1562 | CKWWD | 1547 1558 |
| 1303 | CLRCRM | 1300 |
| 1813 | CLRMSK | 1806 |
| 1032 | CMABFN | 1046 1057 1071 1082 |
| 998 | CMCWAD | 988 |
| 1023 | CMCWBD | 1013 |
| 1012 | CMCWBU | 999 |
| 1048 | CMCWCD | 1038 |
| 1037 | CMCWCU | 1024 |
| 1073 | CMCWDD | 1063 |
| 1062 | CMCWDU | 1049 |
| 1084 | CMCWER | 1074 |
| 895 | CMDAE | 855 |
| 165 | CMDAZ | |
| 877 | CMDBP | 860 |
| 880 | CMDBP2 | 984 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|---------|---|
| 850 | CMDCMD | 783 |
| 859 | CMDCMD1 | 857 |
| 985 | CMDCW | 858 2108 2121 2134 2147 |
| 166 | CMDEL | |
| 636 | CMDERR | 633 763 781 |
| 864 | CMDHCIN | |
| 591 | CMDIN | 572 |
| 1118 | CMDINI | 759 |
| 641 | CMDIRTN | 659 675 691 785 1246 1575 1758 1763 |
| 564 | CMDI | 602 640 |
| 826 | CMDS1 | 775 |
| 812 | CMDS4 | 771 |
| 2023 | CMDULP | 2039 2046 2053 2073 2080 2087 2096 |
| 97 | COMASK | |
| 202 | CORAAS | 1168 2020 2070 2104 |
| 203 | CORABS | 2036 2077 2117 |
| 204 | CORACS | 2043 2084 2130 |
| 205 | CORADS | 2050 2091 2143 |
| 1165 | CORAS | 1159 |
| 1335 | CRLOOP | 1370 |
| 176 | CRMASK | 1353 1354 1358 1359 1362 1363 1366 1367 |
| 1371 | CRNONE | 1327 1330 |
| 1317 | CRRW1 | 1318 |
| 1321 | CRRW2 | 1322 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|----------|---|
| 71 | CSR | 363 372 388 449 451 459 473 475 489 492 577 594 |
| 93 | CTR | 1332 1369 1389 1400 1623 1634 1646 1657 1709 1720 1732 1743 1802 1850 1866 1928 1938 |
| 1517 | CWCALC | 631 |
| 1586 | CWCENDAB | 1592 |
| 1672 | CWCENDCD | 1678 |
| 1589 | CWDNAB | 1582 |
| 1675 | CWDNCD | 1668 |
| 1573 | CWIDLE | 1519 1563 1570 |
| 1594 | CWSTOPAB | 1584 1590 |
| 1680 | CWSTOPCD | 1670 1676 |
| 102 | CWTYPE | 983 1263 |
| 1583 | CWUPAR | |
| 1669 | CWUPCD | |
| 135 | DCLLP | 1069 |
| 132 | DCULP | 1080 1564 2052 2095 |
| 139 | DCWFLG | |
| 1478 | DCWHC | 1472 |
| 160 | DCWMSK | 1282 1478 |
| 161 | DCWTX | 1067 1078 |
| 162 | DCWTY | |
| 163 | DCWTZ | |
| 13A | DDELTA | |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|----------|--|
| 1648 | DDNLPAB | 1658 |
| 1734 | DDNLPCD | 1744 |
| 1643 | DELTDNAB | 1589 |
| 1729 | DELTDNCD | 1675 |
| 1620 | DELTUPAB | 1583 |
| 1706 | DELTUPCD | 1669 |
| 2208 | DLTNPCS | 2101 2113 2127 2139 2156 2166 |
| 2211 | DLTNPL | 2219 |
| 80 | OLYTMR | 236 239 501 503 1314 1317 1320 1321 1393 1394 |
| 196 | DNHCS | 1900 |
| 2194 | DN2STO | 2056 |
| 673 | DOHCOP | 665 |
| 1925 | DOMODE | 1890 1892 1894 1896 1898 1902 1906 1908 1910 1912 1916 1918 1920 1922 |
| 1625 | DUPLPAB | 1635 |
| 1711 | DUPLPCD | 1721 |
| 99 | ECWFLG | 664 687 1299 1753 |
| 681 | ECWHI | 625 |
| 1768 | ECWMG | 1755 |
| 1752 | ECWOPS | 634 |
| 100 | ECWPHZ | 1762 1959 2007 2030 2057 2064 2109 2122 2135 2150 2160 2169 2176 |
| 1958 | ECWSEQ | 1756 |
| 672 | ECWSTO | 618 |
| 2005 | ECWSTO | 1980 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|---------|--|
| 2010 | ECWST1 | 1981 |
| 2089 | ECWST10 | 1990 |
| 2099 | ECWST11 | 1991 |
| 2112 | ECWST12 | 1992 |
| 2126 | ECWST13 | 1993 |
| 2138 | ECWST14 | 1994 |
| 2154 | ECWST15 | 1995 |
| 2061 | ECWST16 | 1996 |
| 2163 | ECWST17 | 1997 |
| 2174 | ECWST18 | 1998 |
| 1970 | ECWST19 | 1972 1999 |
| 2034 | ECWST2 | 1982 |
| 2041 | ECWST3 | 1983 |
| 2048 | ECWST4 | 1984 |
| 2055 | ECWST5 | 1985 |
| 2060 | ECWST6 | 1986 |
| 2067 | ECWST7 | 1987 |
| 2075 | ECWST8 | 1988 |
| 2082 | ECWST9 | 1989 |
| 1978 | ECWTBL | 1963 |
| 101 | ECWTMR | 2006 2063 2094 2149 2171 2182 2185 |
| 1969 | ESQERR | 1961 |
| 95 | FROM | 853 880 1102 1109 1121 1173 1262 1291 2023 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|--------|--|
| 704 | GET2ND | 700 |
| 1005 | GODNA | 1002 |
| 1006 | GODNA1 | 1004 |
| 1030 | GODNB | 1027 |
| 1031 | GODNB1 | 1029 |
| 1055 | GODNC | 1052 |
| 1056 | GODNC1 | 1054 |
| 1080 | GODND | 1077 |
| 1081 | GODND1 | 1079 |
| 994 | GOUPA | 991 |
| 995 | GOUPA1 | 993 |
| 1019 | GOUPB | 1016 |
| 1020 | GOUPB1 | 1018 |
| 1044 | GOUPC | 1041 |
| 1045 | GOUPC1 | 1043 |
| 1069 | GOUPD | 1066 |
| 1070 | GOUPD1 | 1068 |
| 385 | HACDUN | 380 |
| 94 | HACENA | 549 565 2013 |
| 106 | HACIBF | 465 682 699 704 730 754 792 794 796 798 800 802 804 827 850 883 885 1119 2102 2115 2128 2141 |
| 395 | HACIN | 376 |
| 361 | HACIOI | 218 |
| 375 | HACIP | 368 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|---------|--|
| 90 | HACIST | 397 398 470 595 |
| 367 | HACI | 364 |
| 430 | HACKSM | 420 |
| 379 | HACOP | 370 |
| 415 | HACOUT | 381 |
| 462 | HACRD | 567 |
| 175 | HACSTAT | 813 837 838 840 1387 1390 |
| 439 | HACWRT | 815 842 |
| 454 | HACWT1 | 455 |
| 456 | HACWT2 | 457 |
| 408 | HAINST | 401 |
| 105 | HCIBUF | 318 1333 1434 1441 1443 1445 1483 1485 |
| 278 | HCINST | 272 |
| 267 | HCIN | 258 |
| 254 | HCIOI | 214 |
| 89 | HCIST | 267 268 323 1325 1424 |
| 144 | HCMDBF | 551 865 882 897 910 951 1254 1770 2028 2055 2100 2112 2126 2138 2155 2165 |
| 164 | HCMDMSK | 869 884 886 901 1261 2018 2034 2041 2048 2068 2075 2082 2089 |
| 296 | HCOCKS | 288 |
| 1312 | HCOCR | 1242 |
| 303 | HCOOJN | 287 |
| 1376 | HCOPOL | 1243 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|---------|---|
| 1238 | HCOPS | 628 |
| 1253 | HCOSSC | 1240 |
| 285 | HCOOUT | 261 |
| 300 | HCOXIT | 295 |
| 198 | HCPCS | 1879 |
| 1436 | HCPERR | 1426 1429 1431 |
| 1440 | HCPGOOD | 1435 |
| 1392 | HCPLP | 1401 |
| 1394 | HCPWAT | 1395 |
| 314 | HCRD | 1315 1418 |
| 1224 | HCRVRS | 1239 1241 |
| 350 | HCWAT1 | 351 |
| 352 | HCWAT2 | 353 |
| 334 | HCWRT | 1256 1414 |
| 510 | HFCINZ | 217 219 220 221 |
| 190 | HFCMRTN | 545 636 685 758 782 817 |
| 115 | HFCRAM | 511 1296 |
| 109 | HFCSTK | 557 |
| 192 | HFMODE | 584 603 667 689 |
| 189 | HFSTAT | 544 638 639 656 818 820 986 1085 1086 1169 1172 1181 1182 1184 1185 1194 1197 1285 1287 1455 1518 1597 1598 1683 1684 |
| 1134 | ICLAB | 1128 |
| 1152 | ICLCD | 1147 |
| 1127 | ICUAB | 1124 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|--------|---|
| 1146 | ICUCD | 1141 |
| 568 | IDLE | 566 574 612 644 |
| 1140 | IDTAB | 1135 |
| 1158 | IDTCO | 1153 |
| 1194 | INZERR | 1167 1178 |
| 1177 | INZMOV | 1133 1139 1145 1151 1157 1163 |
| 1191 | INZMV3 | 1175 |
| 98 | INZPHZ | 658 778 1129 1166 1177 1179 1199 |
| 514 | INZ00 | 516 |
| 86 | IOCKSM | 278 279 291 292 297 321 339 408 409 423 424 431 445 468 726 1430 |
| 637 | IDERR | 597 600 |
| 84 | IOTA | 255 277 294 319 337 396 406 417 426 443 466 |
| 85 | IOTC | 271 280 286 301 317 336 379 400 410 419 442 464 739 1329 1427 |
| 79 | IOTMR | 232 235 275 305 352 386 404 456 571 1417 1419 |
| 87 | IOWAIT | 269 308 322 340 350 389 399 446 454 469 564 569 |
| 640 | JCMDI | 643 |
| 784 | JCRTN | 760 767 772 774 776 |
| 935 | KILLSB | 867 868 900 |
| 745 | LENTAB | 735 |
| 1874 | MG1HC | 1837 1839 1841 1843 |
| 1928 | MG1RTN | 1923 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|---------|--------------------------------------|
| 1263 | MOV CWA | |
| 1270 | MOV CWB | 1265 |
| 1276 | MOV CWC | 1271 |
| 1282 | MOV CWD | 1277 |
| 1099 | MOVE | 871 890 903 1187 1191 1289 1293 2026 |
| 1496 | MSKBIT | 1461 1468 1475 1480 |
| 1776 | MSKLP1 | 1787 |
| 1851 | MSKLP2 | 1867 |
| 1104 | MVLOOP | 1108 |
| 1285 | MVMSK | 1268 1274 1280 |
| 1356 | NGRP0 | 1352 |
| 1360 | NGRP1 | 1357 |
| 1364 | NGRP2 | 1361 |
| 1368 | NGRP3 | 1340 1365 |
| 1760 | NOECW | 1754 |
| 1486 | NOHCWW | 1456 1481 |
| 690 | NOSUN | 684 |
| 761 | NOTINZ | 757 |
| 777 | NOTSTAT | 769 |
| 773 | NOTST4 | 770 |
| 768 | NOTSUN | 755 |
| 753 | NRMHI | 623 |
| 663 | NRMST0 | 616 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|---------|---|
| 782 | OKCMD | 780 |
| 1483 | PCKILL | 1462 1469 1476 |
| 1407 | POL1HC | 839 1396 |
| 116 | PRIBUS | 362 447 471 487 491 523 575 592 |
| 44 | P1DATA | 324 326 341 343 529 581 583 710 719 721 831 1381 |
| 42 | P1DD | 528 |
| 45 | P2DATA | |
| 43 | P2DD | 531 |
| 1419 | P2WAT | 1420 |
| 58 | P3CSR | |
| 48 | P3DATA | |
| 46 | P3DD | |
| 49 | P4DATA | |
| 47 | P4DD | |
| 64 | RAMCR | |
| 72 | RDR | 375 |
| 610 | REENTR | 586 642 |
| 624 | REENTR1 | 622 |
| 629 | REENTR2 | 627 |
| 632 | REENTR3 | 630 |
| 680 | RSTHI | 620 |
| 649 | RSTST0 | 614 |
| 655 | RSTSTS | 651 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|----------|---|
| 1206 | RVRS3 | 1216 |
| 1205 | RVRS9 | 1225 1226 1227 1228 1229 1231 |
| 1453 | SCREEN | 1440 |
| 1936 | SETMSK | 1880 1926 |
| 61 | SIOCSS | 256 307 327 330 344 347 540 1324 1422 |
| 62 | SIORDR | 270 328 345 |
| 60 | SIORMR | 536 |
| 63 | SIOTDR | 290 299 |
| 92 | SPNUM | 805 829 835 1377 1379 1385 1399 1409 1432 1460 1467 1474 1479 1799 |
| 103 | SPOLBF | 1411 1412 |
| 1295 | SSCNCW | 1260 |
| 1125 | STALL | |
| 107 | STKLIM | |
| 1947 | STMSK1 | 1949 |
| 1597 | STOPCWAB | 1531 1541 |
| 1683 | STOPCWCD | 1560 1572 |
| 960 | STXTL | 962 |
| 948 | STXT | 872 |
| 81 | SUNTMR | 248 547 573 579 717 |
| 145 | SX | 791 1224 |
| 146 | SY | |
| 147 | SZ | |
| 73 | TDR | 382 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|----------|--|
| 96 | TEMP | 1101 1110 2019 2035 2042 2049 2069 2076 2083 2090 2103 2116 2129 2142 2237 2259 |
| 56 | TTCHI | |
| 57 | TICLO | |
| 2187 | TMOT | 2184 |
| 51 | TMRCSP | 228 246 498 538 |
| 52 | TMRHI | 247 |
| 53 | TMRLD | |
| 227 | TOC | 216 |
| 54 | TOCHI | 230 231 534 |
| 55 | TOCLO | |
| 245 | TOF | 215 |
| 2238 | TXCWLOOP | 2242 |
| 2224 | TXCWMSK | 2021 2037 2044 2051 2105 2118 2131 2144 |
| 2260 | TXUPLDOP | 2264 |
| 2246 | TXUPMSK | 2071 2078 2085 2092 |
| 195 | UPHCS | 1888 2224 2227 2230 2233 |
| 697 | VALCMD | 598 |
| 503 | WATBUS | 504 |
| 500 | WATONE | 440 |
| 716 | WDTRST | 702 |
| 197 | WRDNHCS | 1904 |
| 200 | WRUPHCS | 1914 2246 2249 2252 2255 |
| 2189 | WR2STO | 2158 2168 |

DEF ON

| LINE | SYMBOL | REFERENCED ON LINE(S) |
|------|--------|-----------------------|
| 790 | XFRSUN | 764 |
| 240 | XITOC | 237 |
| 909 | XTRACT | 887 904 2029 2205 |
| 912 | XTRLP | 930 |
| 764 | YESSUN | 762 |

STMW-564

I WOULD LIKE TO OBTAIN A COPY OF:

- ① THE SOURCE LISTING OF THE CODE FOR THE HELIOSTAT CONTROLLER ROM OR EPROM
- ② SAME FOR THE HELIOSTAT FIELD CONTROLLER

PLEASE SEND TO:

ARCO POWER SYSTEMS
UNIT #307
7061 S. UNIVERSITY BLVD.
LITTLETON, CO 80122

ATT: J. KAEHLER

THANKS

Jim Kahler
11/17/03

CORDIC ALGORITHM



Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply to:

DOE Site Office
Post Office Box 366
Daggett, CA 92327

Mr. Melvin T. Frohardt
Martin Marietta Aerospace
Post Office Box 179
Denver, CO 80201

DEC 06 1983

Subj.: Closeout Actions on Martin Marietta Contracts with DOE San Francisco Operations Office

Dear Mel:

Nearly six months ago, I requested your assistance in finalizing patent clearance on a number of the documents from the Collector Phase I and Phase II contracts which we wish to enter into the DOE Technical Information Center system. Thus far, I have not had any response to this request. We are about to issue the bibliography developed by Burns & McDonnell under the EPRI-funded "Lessons Learned and Project Documentation" study (I assume you have received a copy of Vol. 1, "Lessons Learned" - if not, let me know and I will send you one), and we and TIC anticipate a substantial number of requests for key documents, including yours.

In addition, SAN Contracts Closeout (Sonia Jackson) advises me that several of the final documents needed to complete closeout (and release final payment of withheld funds), ~~is~~ as yet lacking, not only on the above two contracts, but also on the old Preliminary Design contract. I would greatly appreciate your assistance (or your guidance as to who can assist us) in getting this wrapped up and off both of our desks. To recapitulate (adding the items needed by SAN) for the three contracts:

DE-AC03-76ET20422 (Old Contract-1110), Central Receiver System Prel. Design:

- o A "Final Invoice", to be submitted to Sonia Jackson, with copy to me;
- o "Contractors Assignment of Refunds and Rebates", to Sonia;
- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance" (send to me, only), for:
 - MCR-77-161, "System Safety Design Criteria for Central Receiver...System",
 - MCR-77-162, "System Safety Program Requirements for Solar Thermal Systems".(These were done under an extension to the Preliminary Design contract, and are valuable background documents.)

DE-AC03-78ET21007 Collector System, Phase I:

- o "Final Invoice", to Sonia, copy to me;
- o "Assignment of Funds and Rebates", to Sonia;

- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance", to me, for:
 - MCR-78-1323, "10-MWe Solar Thermal Pilot Plant Conceptual Design Review";
 - MTR-78-1330, "10-MWe Solar Thermal Pilot Plant Preliminary Design Review";
 - MCR-79-1302, "10-MWe Solar Thermal Pilot Plant Final Design Review (2 Vols.)";
 - 40-0-500-4P, "10-MWe Solar Thermal Pilot Plant Phase II O&M Equipment";
 - 40-0-500-6P, "10-MWe Solar Thermal Pilot Plant Phase II Planning."

DE-AC03-80SF10539, Collector System Phase II

- o "Final Invoice", to Sonia, copy to me;
- o "Assignment of Funds and Rebates", to Sonia;
- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance", to me, for:
 - MCR-79-1352B* "Quality Assurance Plan for 10-MWe Phase II Collector..";
 - MCR-80-1304, "10-MWe Solar Pilot Plant Collector Subsystem Safety Plan";
 - MCR-81-1331B, "Hazard Analysis for 10-MWe ...Pilot Plant";
 - 40-0-500-2P, "10-MWe ...Pilot Plant Phase II Mfg. Plan, Rev. 2";
 - MCR-80-1341A, "10-MWe Collector Sybsystem Software/Firmware Functional Req'ts.";
 - MCR-80-1362, "System Description Document, Collector Subsystem...";
 - MCR-80-1376* "Heliostat Stimulator Operators' Manual";
 - MCR-81-1708, "Operation Instructions, Heliostat Field Subsystem...";
 - MCR-81-1709A, "Maintenance Instructions, Heliostat Field Subsystem...";
 - MTR-81-1769, "...Collector Subsystem Functional Test Report";
 - MCR-81-1770, "Supplemental Spares Plan, Heliostat Field...";
 - MCR-80-1377A, "Software/Firmware Design Specifications...";
 - MCR-82-1701, "Control System Theory of Operation";
 - Drawing Set, as Identified in "Drawing Tree 400500 5132701";
 - Source Listing of Code for Heliostat Controller ROM or EPROM*
 - Source Listing of Code for Heliostat Field Controller ROM/EPROM*

Our files do not have current copies of the following other items identified in the Drawing Tree (400500 5132701):

Documents: 40M500-2S, "Foundation Req'ts.", 40M500-1T, "Installation Instructions", 40M500-2M, "Canting Procedures", 40M500-5P, "Acceptance Plan", MCR-80-1361, "Collector System Functional Test Plan", and MCR-81-1715, "Collector System Integrated Acceptance Test Plan."

* Current copies of these four items are lacking from the Project files; your assistance in obtaining at least one copy of each will be most appreciated.

Drawings: 40:500 5132788, "Adapter Plate/Control Arm Heat Tool", 40:500 5132771, "Field Cantino Tool", and 40E500 5132776, "Drive Unit Checkout Console".

While these items are not carried in the current version of the Bibliography (none of the Plant as-built drawings have been entered as yet), many, if not all, of them may be expected to be of interest to the solar community. I would appreciate at least one copy of each, again with your release. To save you considerable effort in preparing the Patent Clearance Request forms (I am enclosing several copies of the form), you may combine many of the above by simply clearing the "Drawing Tree", with its contents.

If you need the other closeout forms cited above (your Contract Administration staff should have them in stock), please call Sonia Jackson at FTS 536-4179, or write her at:

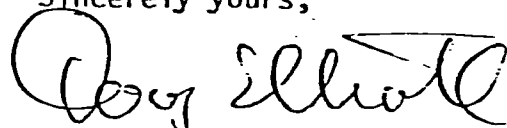
Ms. Sonia Jackson (CM)
Department of Energy
1333 Broadway
Oakland, CA 94612

Finally, since we are required to forward two clean, reproducible copies of each document to DOE/TIC, as well as needing one clean copy for our on-site archives, any "extras" you can turn up around your offices would be greatly appreciated; certainly, rather than throw anything of possible interest out, send it to me.

Mel, I know (believe me!) that this is all a significant amount of work, and I wish I didn't have to ask you (or your staff) to go through it, but it will be to our mutual benefit in the end to get these three contracts all cleaned up, and a comprehensive package of Project documentation (currently, over 550 documents, plus drawings) into the archives. If there is anything further I can do to assist you in this effort, please call on me.

Encl.: DOE Proj. Ofc. ltr. 6/25/83
Patent Clearance Req. Forms

Sincerely yours,



S. D. Elliott, Jr., Director,
DOE Project Office, Barstow

cc: H. C. Wroton, MMC
Sonia Jackson, DOE/SAN (CM)

PS: I keep running across references to a document I can't identify: MCR-78-1325; what was it?

MARTIN MARIETTA AEROSPACE

DENVER DIVISION
POST OFFICE BOX 179
DENVER, COLORADO 80201
TELEPHONE (303) 977-3000

January 30, 1984

Mr. Doug Elliott
DOE Site Office
Post Office Box 366
Daggett, CA 92327

Subject: Closeout Actions on Martin Marietta Contracts with DOE San Francisco Operations Office

Reference: Letter of December 06, 1983, S.D. Elliott, Jr. to M. Frohardt, Closeout of Contracts

In regard to the referenced letter, following is the status and actions in process to close out these items:

1. Contract Closeout Status

In regard to the closeout of cost type contracts DE-AC03-76ET20422, Central Receiver Test Facility, and DE-AC03-78ET21007, Collector System Phase I, we include the "Contractors Assignment of Refunds and Rebates" and "Contractors Release" with our final invoice package. The final invoices for these two contracts will be submitted upon completion of final settlement negotiations for our 1979 overhead and G&A rates which is currently in progress. In reference to the closeout of contract DE-AC03-80SF10539, Collector System Phase II, please see Attachment 1, the letter to Ms. Joann Littlehales dated January 23, 1984, for the current status.

2. Patent Clearance

The following documents are in the process of being cleared by our Patent office. When this transmittal is available, I will send a copy to you.

MCR-78-1323, "10-MWe Solar Thermal Pilot Plant Conceptual Design Review"
MCR-78-1330, "10-MWe Solar Thermal Pilot Plant Preliminary Design Review"
MCR-79-1302, "10-MWe Solar Thermal Pilot Plant Final Design Review (2 Vols)"
40-0-500-4P, "10-MWe Solar Thermal Pilot Plant Phase II O&M Equipment"
40-0-500-6P, "10-MWe Solar Thermal Pilot Plant Phase II Planning"

Mr. Doug. Elliott
January 27, 1984
Page 2

The remainder of the documents have been previously cleared by the following letters, copies of which are included in Attachment 2.

Letters from Phillip DeArment to Roger Gaither:

DAC-83-417, dated May 24, 1983
80-Y-15555, dated July 28, 1980
DAC-82-389, dated May 3, 1982
Letter dated March 11, 1982
Letter dated November 10, 1982

3. Documents

You requested copies of some documents and drawings in the referenced letter. Copies of the following drawings and documents are being submitted under Attachment 3.


MCR-78-1330, "Preliminary Design Review Package"
MCR-79-1352B, "Quality Assurance Plan for 10-MWe Phase II
Collector"
MCR-80-1376, "Heliostat Stimulator Operators' Manual"
40M500-2S, "Foundation Requirements"
40M500-2M, "Canting Procedures"
40M500-1T, "Installation Instructions"
40M500-5P, "Acceptance Plan"
MCR-81-1715, "Collector System Integrated Acceptance Test Plan"
MCR-80-1361, "Collector System Functional Test Plan"
40M500 5132788, "Adapter Plate/Control Arm Heat Tool"
40M500 5132771, "Field Canting Tool"
Source Listing of Code for Heliostat Controller ROM or EPROM*
Source Listing of Code for Heliostat Field Controller ROM/EPROM

No drawing exists for 40E500 5132776, "Drive Unit Checkout Console" as this checkout console consisted of a stimulator to operate a production Drive Mechanism Assembly. Also MCR-78-1330 is the correct document number for the Preliminary Design Review Package rather than MCR-78-1325. MCR-78-1325 is the document number assigned to all the Monthly Progress Reports written during the Phase I contract.

Doug, I hope this will help in getting the documentation finalized. I will follow-up with the additional information identified. If you have any questions please call on me.

Sincerely yours,

MARTIN MARIETTA CORPORATION


Melvin W. Frohardt
Solar Programs

Enclosures

cc: H. Wroton
Sonia Jackson

U.S. DEPARTMENT OF ENERGY
memorandum

DATE **MAY 17 1984**

TO OF Doug Elliott, DOE/Barstow

SUBJECT: Patent Clearance for Two Software Source Listings Developed by Martin Marietta Corporation for 10-MWe Pilot Plant Project under Contract DE-AC03-80SF10539

TO: Roger Gaither, DOE/SAN (OPC)

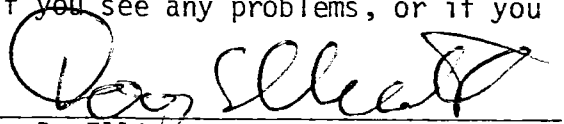
Enclosed are two documents - software source listings for the Pilot Plant heliostat controllers (HC's) and heliostat field controllers (HFC's) - developed by Martin Marietta under their contract for fabrication of the Solar One collector subsystem:

| <u>Primary Document No.</u> | <u>Secondary No.</u> | <u>Brief Title</u> |
|-----------------------------|----------------------|--|
| DOE/SF/10539-14 | (STMP0-564) | "HFC Software Source Listing; Version A02" |
| DOE/SF/10539-15 | (STMP0-565) | "HC Software Source Listing; Version A11..." |

We would like to make these documents available through TIC and NTIS, and also to be able to provide copies to other parties interested in the Solar One control system (we have one such request in hand at present). Initially, MMC had shown some reluctance to make these programs available, and I had discussed with Taylor Belt the possibility of a formal request under contract GP "additional data" articles, and at the same time, I sent off a request for these listings to the MMC program manager, Mel Frohardt (Attch. 1). Taylor reviewed the contract, and pointed out to me that the SOW calls for provision of "program sources in machine-readable form", and that this should be adequate, since MMC had not indicated this material as reserved in any way. In any event, Mr. Frohardt did forward the requested listings in January (Attch. 2) without any reservation.

Since, however, we have a request from one of MMC's competitors in the solar field (ARCO), I would like to be sure we are "extra clean" before sending the listings to them or to TIC/NTIS (even though MMC has announced they are no longer in the solar business). You might wish, then, to check with Phil DeArment on this before clearing these documents. Please let me know if you see any problems, or if you need any further information

Attchs.: 1) DOE ltr. 12/6/83
2) MMC ltr. 1/30/84


S. D. Elliott, Jr., Director,
DOE Solar One Project Office

Encls.: 2 Source Listings, w/Forms 70/RA-426

cc: M. Lopez, DOE/SAN (FGS)
T. Belt, DOE/SAN (OPC)
W. D. Matheny, TIC Document Control
M. Soderstrum, Burns & McDonnell



DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: DOE Solar One Project Office
Post Office Box 366
Daggett, CA 92327

| |
|---|
| Prime Contract No. DE-AC03-80SF10539 |
| Subcontract No. (N/A) |
| Report No. DOE/SF/10539-14 (STMP0-564) |
| Date of Report February 1980 |
| Name & Phone No. of DOE Technical Representative S. D. Elliott, Jr. (619) 254-2672 |

- Document Title:
"HELIOSTAT FIELD CONTROLLER SOFTWARE SOURCE LISTING: Version A02"
- Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
 Copy of Oral Presentation, Other (please specify): _____
- In order to meet a publication schedule or submission deadline, patent clearance by _____ (routine) would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:
- Attention should be directed to pages _____ of this document.
 - This document describes matter relating to an invention:
 - Contractor Invention Docket No. _____
 - A disclosure of the invention was submitted to DOE on _____ (date)
 - A disclosure of the invention will be submitted shortly _____ (approximate date)
 - A waiver of DOE's patent rights to the contractor:

has been granted, has been applied for; or will be applied for _____ (date)

5. This document is being submitted, but no review has been made ^{by me} of this document for possible inventive subject matter.

6. Remarks: Return clearance and review copy to Project Office at address above

Reviewing/Submitting Official: Name (Print/Type) S. D. Elliott, Jr., Director
Title DOE Solar One Project Office
Signature *S. D. Elliott* Date 17 May, 1984

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.
- Please defer release until advised by this office.

Signed _____ Date Mailed _____

U.S. DEPARTMENT OF ENERGY

memorandum

DATE **MAY 22 1984**

REPLY TO
ATTN OF Doug Elliott, DOE/Barstow

SUBJECT Archiving of DOE Contractor-Generated Software at National Energy Software Center
at Argonne National Laboratory

TO Duncan Tanner, SNLL Technical Manager

DOE Order 1360.4 requires that all software generated under DOE contracts, if of any potential value to other DOE contractors or to the general public, be filed ((as computer programs or summaries thereof) with the National Energy Software Center at ANL. Distribution is to be made via NESC, with the exception that in case of urgency, copies may be provided to DOE contractors concurrently with the NESC submission. I am following the latter course in responding to the request for the Martin Marietta Heliostat Controller and Heliostat Field Controller codes to ARCO, who is, in effect, a subcontractor to Pacific Gas & Electric under the Repowering Final Design Cooperative Agreement, but I would like to be sure that in the future we can let NESC take care of such distribution for us.

I would appreciate your assistance in identifying other Solar One software, or suitable summaries thereof (we certainly would not wish to incur the expense or effort, for example, involved in supplying the MDAC "Unit Development Folders" in toto) and in assembling it for transmittal to NESC for distribution on request to future inquirers. I will be "researching" the mechanisms for such transmittal with SAN's Technical Information Coordinator, Don Holz, ascertaining the formats and quantities involved, and setting up the process for those items that may not become available until after you and I leave the site this Fall. Your help in this activity will be greatly appreciated.



S. D. Elliott, Jr., Director,
DOE Solar One Project Office

cc: Mike Lopez, DOE/SAN (FGS)
Don Holz, DOE/SAN (ISEA)

ARCO Power Systems
7061 S. University Boulevard
Suite 307
Littleton, Colorado 80122
Telephone 303 798 1317



May 22, 1984

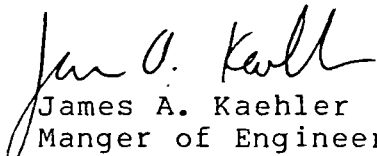
Dr. Doug Elliott, DOE Project Director
Department of Energy
Solar One Site Office
Post Office Box 366
Daggett, CA 92327

I understand from talking to Jim McDowell that the following documents are available:

HELIOSTAT CONTROLLER SOFTWARE SOURCE LISTING
HELIOSTAT FIELD CONTROLLER SOFTWARE SOURCE LISTING

I would appreciate any information you could forward on the above subjects.

Thank You,


James A. Kaehler
Manger of Engineering

JAK/dt



DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

| |
|---|
| Prime Contract No. DE-AC03-80SF10539 |
| Subcontract No. (N/A) |
| Report No. DOE/SF/10539-14 (STMPO-564) |
| Date of Report February 1980 |
| Name & Phone No. of DOE Technical Representative S. D. Elliott, Jr. (619) 254-2672 |

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: DOE Solar One Project Office
Post Office Box 366
Daggett, CA 92327

- Document Title:
"HELIOSTAT FIELD CONTROLLER SOFTWARE SOURCE LISTING: Version A02"
- Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
 Copy of Oral Presentation, Other (please specify): _____
- In order to meet a publication schedule or submission deadline, patent clearance by _____ **(routine)** would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:

- Attention should be directed to pages _____ of this document.
- This document describes matter relating to an invention:
 - Contractor Invention Docket No. _____
 - A disclosure of the invention was submitted to DOE on _____ (date)
 - A disclosure of the invention will be submitted shortly _____ (approximate date)
 - A waiver of DOE's patent rights to the contractor:
 - has been granted, has been applied for; or will be applied for _____ (date)

5. This document is being submitted, but no review has been made ^{by me} of this document for possible inventive subject matter.

6. Remarks: Return clearance and review copy to Project Office at address above

Reviewing/Submitting Official: Name (Print/Type) S. D. Elliott, Jr., Director
Title DOE Solar One Project Office
Signature *S. D. Elliott* Date 17 May, 1984

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office **X**

S. D. Elliott

- No patent objection to above-identified release.
- Please defer release until advised by this office.

Lee
5/21/84
Date Mailed 5/25/84

Signed *L. E. Carnahan*

U.S. DEPARTMENT OF ENERGY
memorandum

DATE JUN 11 1984

REPRODUCTION ATTACHED TO S. D. Elliott, Jr., Director, DOE Solar One Project Office

SUBJECT: Submission of Documents Prepared under Martin Marietta Corporation Contract DE-AC03-80SF10539 for TIC Processing

TO: William D. Matheny, DOE/TIC Document Control


Enclosed are two copies of documents as indicated below for TIC processing, accompanied by DOE Form RA-426:

| <u>Primary Document No.</u> | <u>Secondary No.</u> | <u>Brief Title</u> |
|-----------------------------|----------------------|--|
| DOE/SF/10539-14 | (STMP0-564) | "HFC Software Source Listing; Version A02" |

Copies have been separately provided to DOE/SAN Office of Patent Counsel for Patent Clearance (Attch. 1) and to the National Energy Software Center (Attch. 2).

Encl.: 1 Document (2 copies) w/ Form RA-426

Attch.: 1. Ltr., Proj. Off./SAN/OPC 5/17/84
2. Memo, Proj. Off./SAN/ISEA 6/11/84


S. D. Elliott, Jr., Director,
DOE Solar One Project Office

cc: R. Gaither, DOE/SAN (OPC)
M. Lopez, DOE/SAN (FGS)
D. Holz, DOE/SAN (ISEA)
M. Soderstrum, Burns & McDonnell

U.S. DEPARTMENT OF ENERGY

DOE AND MAJOR CONTRACTOR RECOMMENDATIONS FOR
ANNOUNCEMENT AND DISTRIBUTION OF DOCUMENTS

See Instructions on Reverse Side

| | | |
|--|--------------------------------------|----------------------------------|
| 1. DOE Report No. DOE/SF/10539-14 (STMP0-564) | 2. Contract No. DE-AC03-80SF10539 | 3. Subject Category No. UC-62 |
|--|--------------------------------------|----------------------------------|

4. Title
"HELIOSTAT FIELD CONTROLLER SOFTWARE SOURCE LISTING: Version A02"

5. Type of Document ("x" one)
 a. Scientific and technical report
 b. Conference paper: Title of conference _____
 _____ Date of conference _____
 Exact location of conference _____ Sponsoring organization _____
 c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.) _____

6. Copies Transmitted ("x" one or more)
 a. Copies being transmitted for standard distribution by DOE-TIC.
 b. Copies being transmitted for special distribution per attached complete address list.
 c. Two completely legible, reproducible copies being transmitted to DOE-TIC. (Classified documents, see instructions)
 d. Twenty-seven copies being transmitted to DOE-TIC for TIC processing and NTIS sales.

7. Recommended Distribution ("x" one)
 a. Normal handling (after patent clearance): no restraints on distribution except as may be required by the security classification.
 b. To U.S. Government agencies and their contractors. c. within DOE and to DOE contractors.
 d. within DOE. e. to those listed in item 13 below.
 f. Other (Specify) Archive/issue on request

8. Recommended Announcement ("x" one)
 a. Normal procedure may be followed. b. Recommend the following announcement limitations:

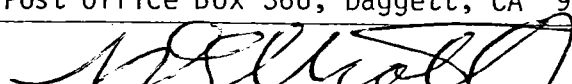
9. Reason for Restrictions Recommended in 7 or 8 above.
 a. Preliminary information. b. Prepared primarily for internal use. c. Other (Explain)

10. Patent, Copyright and Proprietary Information
 Does this information product disclose any new equipment, process or material? No Yes If so, identify page nos. _____
 Has an invention disclosure been submitted to DOE covering any aspect of this information product? No Yes
 If so, identify the DOE (or other) disclosure number and to whom the disclosure was submitted.
 Are there any patent-related objections to the release of this information product? No Yes If so, state these objections.
 Does this information product contain copyrighted material? No Yes
 If so, identify the page number _____ and attach the license or other authority for the government to reproduce.
 Does this information product contain proprietary information? No Yes If so, identify the page numbers _____
 ("x" one a. DOE patent clearance has been granted by responsible DOE patent group.
 b. Document has been sent to responsible DOE patent group for clearance.

11. National Security Information (For classified document only; "x" one)
 Document a. does b. does not contain national security information

12. Copy Reproduction and Distribution
 Total number of copies reproduced 10 Number of copies distributed outside originating organization 5

13. Additional Information or Remarks (Continue on separate sheet, if necessary)

14. Submitted by (Name and Position) (Please print or type)
 S. D. Elliott, Jr., Director, DOE Solar One Project Office
 Organization
 Post Office Box 366, Daggett, CA 92327 (619) 254-2672
 Signature  Date
 MAY 17 1984

U.S. DEPARTMENT OF ENERGY

memorandum

DATE JUN 11 1984

RE TO
ATTN OF S. D. Elliott, Jr., Director, DOE Solar One Project Office

SUBJECT Transmittal of Two Software Source Code Listings Developed by Martin Marietta Corporation under Contract DE-AC03-80SF10539, for 10-MWe Solar Pilot Plant

TO Don Holz, Technical Information Officer, DOE/SAN (ISEA)
National Energy Software Center, ANL

Enclosed are copies of two software source code listings developed by MMC under Contract DE-AC03-80SF10539 for the collector (heliostat) subsystem at the 10-MWe Solar Thermal Central Receiver Pilot Plant ("Solar One"):

OSTI/TIC Doc. No. Title

DOE/SF/10539-14 "Heliostat Field Controller Software Source Listing: Version A02"


DOE/SF/10539-15 "Heliostat Controller Software Source Listing: Version A11-Barstow"

The first document is a listing of the software developed for programming of the sixty-four field control microprocessors used in the collector subsystem, each of which controls up to thirty-two individual heliostats. The second document provides the programming for the 1,818 individual heliostat microprocessors.

These documents have been released by SAN Office of Patent Counsel, and copies are being provided to the Office of Scientific and Technical Information, Oak Ridge, for archiving and announcement via TIC and NTIS. Copies are also being provided to ARCO Power Systems, Littleton, CO, for work under the Carissa Plains Repowering Project, for which they are a subcontractor on Contract DE-FC03-84SF11990.

SAN MD 1430.1 requires (Para. 6.b.(7),(c)) that under such circumstances a copy of the software in question shall be furnished to NESC, via the Technical Information Officer. The enclosed copies are provided for that purpose.

Encls.: 2 Software Source Listings


S. D. Elliott, Jr. (619) 254-2672

cc: M. Lopez, DOE/SAN (FGS)
W. Matheny, DOE/OSTI



Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply to:

DOE Solar One Project Office
Post Office Box 366
Daggett, CA 92327
(619) 254-2672

Mr. James A. Kaehler
Manager of Engineering
ARCO Power Systems, Suite 307
7061 South University Blvd.
Littleton, CO 80122

JUN 11 1984

Subj.: Transmittal of Solar One 10-MWe Pilot Plant HC and HFC Source Code Listings

Dear Jim:

In response to your verbal request via the Sandia Technical Manager last winter, and your written inquiry of May 22, I am providing herewith copies of the MMC source code listings for the heliostat controllers and heliostat field controllers at Solar One. The delay in our response was occasioned by the necessity of obtaining hard-copy listings from MMC, and in entering them into the DOE documentation system. Copies are available to DOE contractors through the DOE Technical Information Center at Oak Ridge (and, for others, through NTIS), or from the National Energy Software Center at Argonne National Laboratory; rather than make you take the added time to go through these sources, I have had this extra set run for direct transmittal for your use on the Rockwell Carissa Plains project.

For further particulars on the programs themselves, I suggest you contact Duncan Tanner, the Sandia Technical Manager, at (619) 254-2971; please let me know if there is any way in which I can be of further assistance.

Encls.: 2 Software Source Code Listings

cc: Duncan Tanner, SNLL/Barstow

Sincerely yours,

S. D. Elliott, Jr., Director,
DOE Solar One Project Office

STMPD

(1)

564

Fri 6 July 84

0810 TTC ← Margaret Dutton NESK re MARCHE
≥ CFE software - probably to be used for
general dissemination. - also, NESK makes
modern-usable data. Will just
summarize for now. Will send me Co-
chairs on NESK ≥ copy DUE circle.

STMPRO - 564 ✓

National Energy Software Center

Argonne National Laboratory 9700 South Cass Avenue Argonne, Illinois 60439 312/972-7250

July 7, 1984

S. D. Elliott, Jr., Director
DOE Solar One Project Office
P. O. Box 366
Daggett, CA 92327

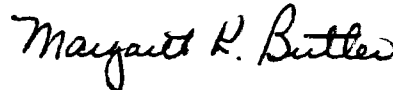
Dear Mr. Elliott:

I am enclosing copies of the Center's brochure and Installation Representative Guide as promised in our telephone conversation. I believe these will serve to introduce you to the NESC program. The copy of DOE Order 1360.4 which you requested is enclosed, also.

My first impression on receiving the microprocessor software source listings was that the software was designed for a unique application and would only be useful as a guide to others attempting to develop similar software for different applications. Consequently, they would only need the software in human-readable form. After our discussion, I am not sure. Perhaps the best way to let people know of the availability of the software would be through publication of an NESC Summary describing the application and noting the availability of the source listings. However, if the software is such that it would be useful to others in machine-readable form, we need to consider making it available in that form. How is the machine-readable software stored?

Please call me after you have looked over the enclosed material, and we can discuss the best way to handle this particular software.

Sincerely,



Margaret K. Butler

Enclosures:
As stated

2-2-83

SUBJECT: COMPUTER SOFTWARE SHARING

1. PURPOSE. To prescribe Departmental policies and procedures for the effective sharing of computer software developed by the Department of Energy (DOE) for scientific, technical, and technology related applications, so that the duplication of software development is minimized.
2. EXCLUSIONS. This Order excludes management information systems (MIS) covered by DOE 1330.1, operational systems, and operational proprietary software.
3. REFERENCES.
 - a. DOE 1330.1, ENERGY AND MANAGEMENT INFORMATION SYSTEMS REVIEW, COORDINATION, AND INTEGRATION, of 8-1-78, which establishes policy to ensure proper review and coordination of the development and modification of energy information systems and management information systems.
 - b. DOE 1340.1A, MANAGEMENT OF PUBLIC COMMUNICATIONS PUBLICATIONS, AND SCIENTIFIC, TECHNICAL, AND ENGINEERING PUBLICATIONS, of 8-25-82, which prescribes policies, standards, and procedures for effective management of DOE publications.
 - c. DOE 1360.1, ACQUISITION AND MANAGEMENT OF AUTOMATIC DATA PROCESSING EQUIPMENT AND RESOURCES, of 8-9-78, which establishes Departmental policies and procedures for the acquisition and management of automatic data processing (ADP) equipment and resources.
 - d. DOE 1360.2, COMPUTER SECURITY PROGRAM FOR UNCLASSIFIED COMPUTER SYSTEMS, of 3-9-79, which establishes Departmentwide policies and procedures for developing, implementing, and administering a program for safeguarding DOE computer systems and in particular DOE sensitive unclassified information.
 - e. DOE 1360.3, AUTOMATIC DATA PROCESSING AND DATA COMMUNICATIONS STANDARDS, of 3-27-79, which establishes Departmentwide policy for the development and implementation of Departmental ADP and data communications standards.
 - f. Federal Property Management Regulation, 41 CFR Subpart 101-36.16, Federal Software Exchange Program, of 6-78, which provides policy and procedures describing the Federal Software Exchange Program, the reporting of common-use ADP software to the Federal Software Exchange Center and subsequent use of this information for Governmentwide sharing.
 - g. Paperwork Reduction Act of 1980, Public Law 96-511, U.S.C. 101, which is an act to reduce paperwork and enhance the economy and efficiency of the Government and the private sector by improving Federal information policymaking, and for other purposes.

DISTRIBUTION:All Departmental Elements
Federal Energy Regulatory Commission (info)

INITIATED BY:

Technical Information Center

- h. "U.S. Department of Energy National Energy Software Center Installation Representative Guide," of 9-79, ANL/NESC-1, which is an introduction and reference manual to the program and operating procedures of the National Energy Software Center, and is available from Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439.

4. DEFINITIONS.

- a. Computer Software. Those computer programs and routines with scientific, technical, and technology related applications used to extend the capabilities of computers. Software includes independent subroutines, related groups of routines, single programs, and sets or systems of programs. Software normally provided by the computer manufacturer, as well as that nonmanufacturer supplied operational proprietary and operational system software necessary to ensure fundamental operability of the automated data processing equipment, are excluded.
- b. Common-Use Software. That portion of software which deals with problems common to many Agencies or components of the DOE, that would be useful to other Agencies or components of the DOE, and is written in such a way that minor variations in requirements can be accommodated without significant programming effort.
- c. Software Summary. A condensed description or abstract of a computer program or automated data system.
- d. Specialized Computer Software Center. Those DOE and DOE-contractor operations that collect, test, announce, and provide computer software in specialized subject areas (e.g., radiation shielding or nuclear data).

5. BACKGROUND.

- a. Computer programs are expensive to develop, test, and modify. Computer centers can benefit from being able to learn of and obtain software already developed.
- b. DOE organizations and contractors develop computer software that has value to others within DOE and to other Government Agencies, Government contractors, and to the private sector.
- c. DOE organizations and contractors can benefit from a central clearinghouse of information on computer software.
- d. The National Energy Software Center, a DOE contractor effort formerly known as the Argonne Code Center, has been established to effect computer software sharing by collecting, reviewing, testing, packaging, and distributing computer software programs developed by the Department of Energy and its contractors. The National Energy Software Center ensures, insofar as practicable, that the package contains all computer-readable elements and information necessary for use of the software by individuals, other than authors, in computer environments different from that in which the software was developed. No computer software that is classified for national security

2-2-83

reasons is processed by the National Energy Software Center. The National Energy Software Center provides a Departmental focal point for exchanges with the U.S. and foreign organizations and for Departmental participation in the Federal Software Exchange Program.

- e. Federal Property Management Regulation 41 CFR 101-36.16 establishes the Federal Software Exchange Program requiring software sharing within the Federal Government. DOE complies with this regulation through the operation of the National Energy Software Center collecting, processing, and distributing all DOE software, thus serving as one DOE contact point for the Federal Software Exchange Program and effecting efficiencies over the alternative of the Federal Software Exchange Program having to collect software from each DOE organization and contractor.
- f. The Technical Information Center provides funding and programmatic direction to the National Energy Software Center. Software is an information product similar to scientific and technical reports in that it has value beyond the purpose for which the software was originally prepared. The Technical Information Center provides central implementation of DOE policy for the control of technical information products including computer software.
- g. Specialized computer software centers have been formed to share software in specialized technical areas and are usually located in laboratories where research and development is proceeding and where there is close coordination between the specialized centers and research and development staff. These centers serve a function similar to that of the National Energy Software Center but in a limited, specialized technical area and are responsible for determining that their activities do not duplicate the activities of the National Energy Software Center. These centers are the Engineering Physics Information Center of the Oak Ridge National Laboratory and the National Nuclear Data Center of Brookhaven National Laboratory.

6. POLICIES. DOE shall:

- a. Promote the sharing and exchange of computer software among DOE organizations and contractors so that duplication of effort is minimized.
- b. Promote the sharing of DOE-developed computer software with other Government Agencies as required by FPMR 41 CFR 101-36.16.
- c. Establish a focal point which maintains a central clearinghouse of information on computer software for the sharing of software.

7. RESPONSIBILITIES.

- a. Director of Administration, develops policies for computer software sharing by DOE and its contractors.

b. Manager of Technical Information Center

- (1) Provides funding and programmatic direction of the National Energy Software Center to achieve effective software sharing.
- (2) Develops procedures for collecting, announcing, and disseminating computer software developed or acquired by DOE and its contractors.
- (3) Integrates the announcement and dissemination functions of the National Energy Software Center into the Departmentwide technical information program conducted by the Technical Information Center.
- (4) Implements policy concerning foreign dissemination of computer software.

c. Contracting Officers ensure that computer software, when developed through DOE contracts and grants, becomes DOE property and is available to the National Energy Software Center.

d. Heads of Departmental Elements.

- (1) Ensure that procurement request packages contain provisions obtaining DOE rights to computer software developed at DOE expense and requiring use of the procedures in this Order.
- (2) Verify that specialized computer software centers coordinate their activities with the National Energy Software Center to minimize overlap of software offered and follow policy regarding computer software sharing and dissemination.

8. PROCEDURES AND REQUIREMENTS.

- a. Before developing new computer software, DOE organizations and contractors are encouraged to contact the National Energy Software Center directly or review descriptions to determine whether the required software already exists or is under development.
- b. DOE organizations and contractors shall provide the National Energy Software Center with the computer-readable and other package material for common-use software developed under Departmental sponsorship and released by the originator or believed by the originator to have value to other sites; procedures for this are given in the "National Energy Software Center Installation Representative Guide." Software summaries shall be supplied for DOE-sponsored software that has not been sent to the National Energy Software Center because of its preliminary status or its limited potential application.
- c. DOE organizations and contractors may provide computer software directly to other DOE organizations and contractors upon request provided that a copy is submitted to the National Energy Software Center at the same time it is submitted to the requester. Software will be provided to contractors under this provision only for use in performing contract functions.

2-2-83

- d. Dissemination outside the Department shall be through the National Energy Software Center or through the appropriate DOE-sponsored specialized computer software center. Requests from outside the Department for DOE-developed computer software shall be referred to the National Energy Software Center or to the appropriate DOE-sponsored specialized computer software center.
- e. DOE-sponsored specialized computer software centers shall keep the National Energy Software Center informed of any computer software that they disseminate.
- f. Before disseminating, transmitting, or using computer software, DOE organizations, National Energy Software Center, and other DOE computer software centers shall ascertain that such action is consistent with DOE's rights to the computer software. In cases where there are restrictions against further dissemination of software, appropriate agreements from recipients prohibiting such further dissemination shall be obtained.
- g. Requests for exceptions to these requirements shall be submitted to the Manager of Technical Information Center for approval after coordination with interested Headquarters organizations.



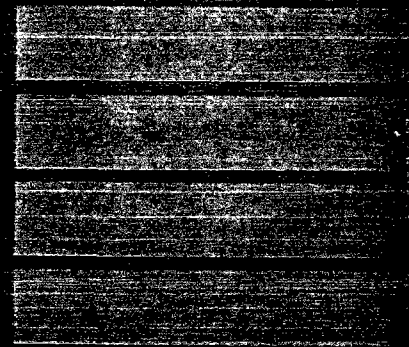
WILLIAM S. HEFFELFINGER
Director of Administration

DOE TIC-11469(Rev.1)
(DE83003194)

National Energy Software Center

operated for the
Technical Information Center
U.S. Department of Energy
Oak Ridge, Tennessee

by the
Argonne National Laboratory
Argonne, Illinois





ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct

access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.



UNITED STATES DEPARTMENT OF ENERGY

Donald Paul Hodel
Secretary

Martha O. Hesse
Assistant Secretary
Management and Administration

William S. Heffelfinger
Director of Administration

Joseph G. Coyne
Manager
Technical Information Center

NATIONAL ENERGY SOFTWARE CENTER

The National Energy Software Center (NESC) at Argonne National Laboratory is operated for the DOE Technical Information Center to effect the sharing of computer software for DOE offices and DOE contractors. NESC has four responsibilities: (1) operation of a software information and resource center for acquiring, processing, announcing, and distributing DOE-sponsored computer software and data compilations; (2) acquisition for DOE use through the exchange process, announcement, and distribution of energy-related software produced in foreign countries; (3) assistance to DOE computer facilities in identifying needed non-DOE software; and (4) management and control of the transfer of DOE-developed software to other government agencies, foreign organizations, and private sector U.S. commerce and industry in compliance with federal laws and regulations.

NESC is the successor to the Argonne Code Center established in 1960.

Prepared by the
Technical Information Center
U. S. Department of Energy

This booklet is available
free from the

U. S. Department of Energy
National Energy Software Center
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

and free (as Order No. DE83003194
[Report No. DOE/TIC-11469(Rev.1)]
from the

U. S. Department of Energy
Technical Information Center
P. O. Box 62
Oak Ridge, Tennessee 37831

12/83

Printed in the United States of America
USDOE Technical Information Center, Oak Ridge, Tennessee

National

**E
N
E
R
G
Y

S
O
F
T
W
A
R
E**

Center



**ANL/NESC-1 (Rev.)
(DE83008451)**

INSTALLATION REPRESENTATIVE GUIDE

**May 1983
Date Published**

**Argonne National Laboratory
Argonne, Illinois**

**TECHNICAL INFORMATION CENTER
U. S. DEPARTMENT OF ENERGY**

DISCLAIMER

"This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof."

This report is available as DE83008451 from the National Technical Information Service,
U. S. Department of Commerce, Springfield, Virginia 22161.

Price: Printed Copy A02
Microfiche A01

STMPU 504/505



SEP 25 1984

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Ms. Margaret K. Butler
National Energy Software Center
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

Solar One Project Office Recommendation Regarding "Heliostat Controller Software Listing" and "Heliostat Field Controller Software Listing", Contract DE-AC03-80SF10539

Dear Ms. Butler:

I am sorry it has taken so long to respond to your letter of July 7 regarding the two print-outs sent you via DOE/SAN in June. The material you sent was most informative about NESC's functions, about which we had heard very little previously.

Your suggestion about preparing an NESC Summary and obtaining machine-readable tapes is well-taken. In this case, however, it would appear that the software, being designed for a unique application (in the sense that another user would probably prefer to develop his own program), as you state you at first thought, is adequate in its present form. Frankly, the submission was made to comply with the requirement that NESC be provided with a copy of any software distributed outside the project. We had had one request for it, from a former employee of Martin Marietta subsequently involved in another project for DOE (which itself has since been terminated); he had adequate background to use the material as provided. Since that time, we have not had, nor do we expect, further requests for this material. In my opinion, therefore, it does not warrant the effort involved in preparing the Summary; nor, since the contract under which it was prepared is now in closeout, are we in a position to go back to MMC for a machine-readable copy. Finally, this Office is to be closed as of September 28, and there will be no-one remaining from DOE to oversee such activity. I therefore recommend that we simply leave things as they are.

Thank you once again for your help; I wish you and NESC success in your endeavors.

Sincerely yours,

S. D. Elliott, Jr., Director,
DOE Solar One Project Office

cc: M. Lopez, DOE/SAN (FGS)
D. Holz, DOE/SAN (ISEA)