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DECUS NO. 8-395 LISTING

TITLE SPACE WAR

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/       SPACE WAR

/       INTERPLANETARY DEATH AND DESTRUCTION ON YOUR
/       LAB-8
/
/       EVAN SUITS
/
/       THIS VERSION WORKS OFF EITHER THE BLUE RIBBON CONNECTOR OR THE
/       SR.  WHEN THE PROGRAM IS STARTED (AT 0200) OR RESTARTED THE
/       SR WILL BE TESTED AND IF =0000 WILL BE USED FOR THE COMMAND
/       INPUT.  OTHERWISE, THE BLUE RIBBON CONNECTOR (AX08 * C0-C7 *
/       XR OPTION ONLY) CONTINGENCY INPUTS WILL BE USED.
/
/       WHEN THE PROGRAM IS STARTED THE TWO SHIPS SHOULD
/       APPEAR ON THE SCREEN WITH SHIP 'ONE' ON THE LEFT, SHIP
/       'TWO' ON THE RIGHT.
/
/       THE COMMAND WORD BIT ASSIGNMENTS ARE:
/
/       SR BIT:         C:      FUNCTION:
/
/       0               0       SHIP ONE ROTATES LEFT
/
/       1               1       SHIP ONE ROTATES RIGHT
/
/       2               2       SHIP ONE ACCELERATES
/
/       3               3       SHIP ONE FIRES
/
/
/       8               4       SHIP TWO ROTATES LEFT
/
/       9               5       SHIP TWO ROTATES RIGHT
/
/       10              6       SHIP TWO ACCELERATES
/
/       11              7       SHIP TWO FIRES
/
/
/       NOTE THAT TURNING RIGHT AND LEFT SIMULTANEOUSLY THROWS
/       THE SHIP INTO HYPERSPACE.  IN THE CURRENT VERSION THE ODDS
/       ARE IN FAVOR OF YOUR MAKING IT BACK SAFELY.  THE GAME IS OVER
/       WHEN ONE OR BOTH OF THE SHIPS HAVE BEEN DESTROYED AND THE
/       WINNER (IF ANY) IS IN NORMAL SPACE.  WHEN THE WINNER
/       HAS BEEN ANNOUNCED, HIT ANY TTY KEY TO RESTART.
/
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                /       SYMBOL DEFINITIONS FOR PAL8-PAL10

          6342  ZTEN=6342
          6344  OTEN=6344

          6331  XRIN=6331
          6334  XRCL=6334

          6321  SKXK=6321
          6352  CLXK=6352

          6324  DSB=6324

          6301  DXC=6301
          6311  DYC=6311
          6302  DXL=6302
          6312  DYL=6312
          6304  DIS=6304

          6072  CRF=6072
          6052  CCF=6052
```

```
                        /
                        /       THIS PROGRAM RELIES ON THE PROGRAM INTERUPT FACILITY FOR
                        /       REAL WORLD TIMING PURPOSES.
                        /
                0000            *0
00000   0000            0                       /EFFECTIVE JMS 0 ON PROGRAM INTERUPT
00001   5402            JMP I 2                 /EXIT IMMEDIATLY TO SERVICE ROUTINE
00002   0313            INTSER
00003   0000    EMPTY,  0                       /THESE LOCATIONS ARE RESERVED FOR
00004   0000    ODT1,   0                       /DEBUGGERS, ETC.
00005   0000    ODT2,   0
00006   0000    ODT3,   0
                        /
                        /       ALL THE AUTO INDEX REGISTERS ARE NAMED BUT NOT ALL OF
                        /       THEM ARE USED. THE STATUS OF ANY GIVEN REGISTER CANNOT
                        /       BE DETERMINED AT ANY TIME EXCEPT BY CAREFUL INSPECTION OF
                        /       THE CODE.
                        /
                0010            *10
00010   0000    AUTO10, 0
00011   0000    AUTO11, 0
00012   0000    AUTO12, 0
00013   0000    AUTO13, 0
00014   0000    AUTO14, 0
00015   0000    AUTO15, 0
00016   0000    AUTO16, 0
00017   0000    AUTO17, 0
                        /
                        /       THE FOLLOWING ARE THE DATA FILES FOR THE TWO SPACE SHIPS
                        /       AS WELL AS CERTAIN OTHER PARAMETERS FOR CALCULATING POSITIONS
                        /       AND SO ON.  THE ORDER OF THE LOCATIONS MUST BE PRESERVED
                        /       ALTHOUGH THE SIZE OF THE TABLES MAY BE VARIED
                        /
                0020            *20
00020   0000    ONEOUT, 0                       /IF NON-ZERO CONTAINS REAMINING TIME OF EXPLOSION
00021   0000    ONECNT, 0                       /NUMBER OF POINTS IN FIGURE TO BE DISPLAYED
00022   0000    ONEFLG, 0                       /IN OR OUT OF NORMAL SPACE
00023   0000    ONETHE, 0                       /ANGLE OF ORIENTATION ON SCREEN
00024   0000    ONEVEX, 0                       /X COMPONENT OF VELOCITY
00025   0000    ONEVEY, 0                       /Y COMPONENT OF VELOCITY
00026   0000    ONEPEX, 0                       /X POSITION (12 BITS)
00027   0000    ONEPEY, 0                       /Y POSITION (12 BITS)
00030   0000    ONESIN, 0                       /SINE OF ANGLE
00031   0000    ONECOS, 0                       /COSINE OF ANGLE
00032   0000    ONEFIN, 0                       /SET WHEN EXPLOSION DIES OUT
```

```
129   00033  0000  TWOOUT, 0                       /SAME CONTENT AND ORDER
130   00034  0000  TWOCNT, 0                       /AS ABOVE
131   00035  0000  TWOFLG, 0
132   00036  0000  TWOTHE, 0
133   00037  0000  TWOVEX, 0
134   00040  0000  TWOVEY, 0
135   00041  0000  TWOPEX, 0
136   00042  0000  TWOPEY, 0
137   00043  0000  TWOSIN, 0
138   00044  0000  TWOCOS, 0
139   00045  0000  TWOFIN, 0
140
141
142                /
143                /       THESE LOCATIONS ARE USED BY THE "VECTOR GENERATOR" IN
144                /       DISPLAYING THE FIGURES.  A FOUR DOT VECTOR WILL BE DRAWN
145                /       FROM XONE,YONE TO XTWO,YTWO WITH STEPS OF SIZE DIXTEM,DIYTEM
146                /
147
148   00046  0000  XONEDS, 0
149   00047  0000  YONEDS, 0
150   00050  0000  XTWODS, 0
151   00051  0000  YTWODS, 0
152   00052  0000  DIXTEM, 0
153   00053  0000  DIYTEM, 0
154   00054  0000  DISCNT, 0
155
156
157                /
158                /       THE NEXT LOCATIONS ARE USED BY CALPOS TO DO A FAST
159                /       MULTIPLY TO HELP CALCULATE THE DISPLAY FILES.
160                /
161   00055  0000  T10SIN, 0
162   00056  0000  T20SIN, 0
163   00057  0000  T30SIN, 0
164   00060  0000  T10COS, 0
165   00061  0000  T20COS, 0
166   00062  0000  T30COS, 0
167
168   00063  0000  CALSIN, 0
169   00064  0000  CALCOS, 0
170
```

```
                        /
                        /       NOW COME THE VARIOUS ODDS AND ENDS ONE USUALLY FINDS ON
                        /       PAGE ZERO
                        /

00065  6400  SINE,    SINEIN
00066  6463  COSINE,  COSINI
00067  6621  MULT,    MULTI
00070  6675  RSHIFT,  SHIFTR
00071  1475  VECTOR,  DISPLY
00072  6703  CALPOS,  POSCAL
00073  0000  INTWRD,  0
00074  0000  INTCNT,  0
00075  0000  CLOCK,   0
00076  2200  HYPER,   HYPSET
00077  7000  MESOUT,  CHARS
00100  2475  THEADJ,  THEAJI
00101  2451  VEESCL,  VEELIM
00102  1535  ISHFT,   DISHFT
00103  1675  RESET1,  RESE1
00104  0000  GAMOVR,  0
00105  0000  ACCFLG,  0
00106  7750  ACCPER,  -30
00107  7400  MEXP,    -400

00110  0000  PROX,    0
00111  0000  PROY,    0
00112  7420  PROLIF,  -360
00113  0000  BUFTMP,  0
00114  7400  ONEFIL,  DISBUF
00115  7440  TWOFIL,  DISBUF+40

00116  0005  P5,      5
00117  0010  P10,     10
00120  0017  P17,     17
00121  0020  P20,     20
00122  0037  P37,     37
00123  0040  P40,     40
00124  0100  P100,    100
00125  0132  P132,    132
00126  0200  P200,    200
00127  0400  P400,    400
00130  0550  P550,    550
00131  3777  P3777,   3777

00132  7774  M4,      -4
00133  7772  M6,      -6
00134  7770  M10,     -10
00135  7767  M11,     -11
00136  7514  M264,    -264
00137  7600  M200,    -200
00140  7400  M400,    -400
00141  7230  M550,    -550
```

```
                        /
                        /       THE PROGRAM MAY BE STARTED OR RESTARTED AT ANYTIME AT 0200.
                        /       THE DATA FILE ON PAGE ZERO IS CLEARED, ALL FLAGS INITIALIZED,
                        /       AND THE SR EXAMINED.  IF THE SR=0 THE DISPLAY UPDATE ROUTINES
                        /       ARE SET TO PICK UP THE STATUS WORD FROM THE SR.  IF THE SR
                        /       DOES NOT EQUAL ZERO, THE STATUS WORD IS READ FROM THE EIGHT
                        /       CONTINGENCY INPUTS ON THE BLUE RIBBON CONNECTOR OF THE AX08
                        /       (XR OPTION ONLY).  JUMP IS THEN TO THE DISPLAY
                        /       FILE UPDATE TO START OFF THE GAME.
                        /

                0200            *200

00200   7300    START,  CLA CLL                 /START OR RESTART HERE ANY OLD TIME
00201   7604            LAS                     /SR
00202   7650            SNA CLA
00203   1311            TAD SWRD                /USE THE SR
00204   1312            TAD XROPT               /USE THE BLUE RIBBON CONNECTOR
00205   3251            DCA COLDST              /AND LEAVE IN THE TRAP LOCATION

00206   7240    RESTRT, CLA CMA
00207   6334            XRCL
00210   7300            CLA CLL

00211   1120            TAD P17                 /FIRST CLEAR THE POSITION AND DATA
00212   3010            DCA AUTO10              /TABLES OF THE TWO SHIPS
00213   1303            TAD TABLEN
00214   3011            DCA AUTO11
00215   3410            DCA I AUTO10
00216   2011            ISZ AUTO11
00217   5215            JMP .-2

00220   1307            TAD STRT1               /SET THE STARTING POSITIONS OF THE
00221   3026            DCA ONEPEX              /TWO SHIPS
00222   1310            TAD STRT2
00223   3041            DCA TWOPEX
00224   1122            TAD P37                 /SET TRIG FUNCTIONS JUST IN CASE
00225   3031            DCA ONECOS
00226   1122            TAD P37
00227   3044            DCA TWOCOS              /ZERO DEGREES IS POINTING STRAIGHT UP
00230   1106            TAD ACCPER              /SET COUNT FOR VELOCITY INCREASE
00231   3105            DCA ACCFLG
00232   3032            DCA ONEFIN              /CLEAR ALL GAME END FLAGS
00233   3045            DCA TWOFIN
00234   3104            DCA GAMOVR
00235   4702            JMS I BUFSET            /RESET ALL PROJECTILE DISPLAY BUFFERS
00236   1127            TAD P400                /START UP THE CRYSTAL CLOCK IN THE AX08
00237   6342            ZTEN
00240   6344            OTEN
00241   6042            TCF                     /CLEAR OTHER REMAINING LIKELY FLAGS
00242   6022            PCF
00243   6012            RRB
00244   6072            CRF
00245   6052            CCF
```

```
 281   00246  7200          CLA
 282   00247  5251          JMP COLDST              /AND GO TO IT
 283
```

```
                        /
                        /       UPDATE IS REACHED WHENEVER THE PROGRAM IS STARTED OR THE
                        /       CLOCK COUNT OVERFLOWS INDICATING TIME TO RECALCULATE THE
                        /       THE DISPLAY FILES AND REFRESH THE DISPLAY.  THE INTERUPT
                        /       COUNT IS RESTORED, THE STATUS WORD IS PICKED UP FROM EITHER
                        /       THE SR OR BRC, AND THE RECALCULATION PROCESS BEGUN.
                        /

00250  7300  UPDATE, CLA CLL                  /HERE ON CLOCK COUNT OVERFLOW.
                                              /START NEXT SWEEP
00251  0000  COLDST, 0                        /TRAP TO READ SR OR BRC
00252  7604          LAS                     /HERE FOR SR
00253  3073          DCA INTWRD              /STORE TEMPORARILY
00254  1073          TAD INTWRD              /MASK OUT LEFTMOST 4 BITS
00255  7012          RTR                     /FOR NUMBER ONE
00256  7012          RTR
00257  0305          AND LFTHAF
00260  3304          DCA INTTEM              /AND STORE
00261  1073          TAD INTWRD              /MASK OUT RIGHTMOST BITS FOR NUMBER TWO
00262  0306          AND RYTHAF
00263  1304          TAD INTTEM              /ADD TOGETHER
00264  5267          JMP .+3                 /AND CONTINUE

00265  6331  CODST,  XRIN                    /HERE FOR BRC - PICK UP AND CLEAR
00266  6334          XRCL
00267  3073          DCA INTWRD              /CONTINUE
00270  1141          TAD M550                /RESTORE INTERUPT COUNT BEFORE NEXT
00271  3074          DCA INTCNT              /UPDATE
00272  6001          ION                     /GET READY FOR THE NEXT CYCLE
00273  1105          TAD ACCFLG              /ALLOW VELOCITY INCREASE THIS TIME?
00274  7001          IAC                     /ONLY WHEN ACCFLG=0
00275  7540          SMA SZA
00276  1106          TAD ACCPER              /IF ZERO, RESET COUNT
00277  3105          DCA ACCFLG

00300  5701          JMP I .+1               /NOW GET DOWN TO WORK.
00301  0400          ONEUP

00302  1726  BUFSET, SETBUF
00303  7733  TABLEN, AUTO17-CALCOS
00304  0000  INTTEM, 0
00305  0360  LFTHAF, 0360
00306  0017  RYTHAF, 0017
00307  1000  STRT1,  1000
00310  7000  STRT2,  -1000
00311  1513  SWRD,   2000-CODST
00312  5265  XROPT,  JMP CODST
```

```
                        /
                        /       THIS IS THE INTERUPT SERVICE ROUTINE.  MOST OF THE
                        /       INTERUPTS WILL BE FROM THE CRYSTAL CLOCK WHICH WILL BE
                        /       COUNTED AND UNLESS THE COUNT OVERFLOWS THE INTERUPT IS
                        /       DISMISSED IMMEDIATLY.  IF THE COUNT OVER FLOWS, JMP IS TO
                        /       UPDATE WITH IOF.
                        /
                        /       SPECIAL CASE IS KEYBOARD INTERUPT WHEN THE GAMOVR FLAG IS
                        /       SET IN WHICH CASE THE GAME IS RESTARTED.
                        /
                        /       UNEXPECTED INTERUPTS ARE COUNTED AND AFTER ENOUGH OF THEM
                        /       HAPPEN THE PROGRAM HALTS.  IF THIS HAPPENS RELOAD OR FIND THE
                        /       STRANGE FLAG
                        /

00313  3346  INTSER,  DCA INTACC          /HERE RIGHT AFTER INTERUPT - STORE
00314  7010           RAR                 /AC AND LINK
00315  3347           DCA INTLNK          /FOR POSSIBLE CONTINUATION
00316  6321           SKXK                /WAS IT THE CRYSTAL CLOCK?
00317  5326           JMP INTBUS          /NO TRY SOMETHING ELSE
00320  6352           CLXK                /YES CLEAR THE FLAG
00321  2075           ISZ CLOCK           /AND BUMP CLOCK COUNTER
00322  7000           NOP                 /IGNORE OVERFLOW
00323  2074           ISZ INTCNT          /TIME FOR AN UPDATE?
00324  5340           JMP INTRET          /NO, DISMISS THE INTERUPT
00325  5250           JMP UPDATE          /YES, GO TO IT

00326  6031  INTBUS,  KSF                 /HERE ON NON-CLOCK INTERUPT
00327  5334           JMP .+5             /NOT THE KEYBOARD
00330  6032           KCC                 /CLEAR KEYBOARD FLAG
00331  1104           TAD GAMOVR          /IS THE GAMEOVER
00332  7640           SZA CLA
00333  5206           JMP RESTRT          /YES, RESTART
00334  6042           TCF                 /NO, HELL WITH IT
00335  2350           ISZ INTGLH          /COUNT ONE BADDIE
00336  7410           SKP
00337  7402           HLT                 /HALT IF TOO MANY BADDIES

00340  7300  INTRET,  CLA CLL             /HERE TO DISMISS THE INTERUPT
00341  1347           TAD INTLNK
00342  7004           RAL
00343  1346           TAD INTACC
00344  6001           ION
00345  5400           JMP I 0

00346  0000  INTACC,  0
00347  0000  INTLNK,  0
00350  0000  INTGLH,  0
```

```
                        /
                        /       NOW BEGINS THE GREAT UPDATE PROCEEDURE, FIRST FOR SHIP
                        /       NUMBER ONE (THE DELTA SHAPED SHIP WHICH APPEARS ON
                        /       THE LEFT AT THE START OF THE GAME).  IF ALIVE THE STATUS
                        /       WORD (INTWRD) IS TESTED FOR REQUESTS FOR LEFT TURN,
                        /       RIGHT TURN, THRUST ON, AND LAUNCH PROJECTILE.  THESE ACTIONS
                        /       MAY OR MAY NOT BE ACTED UPON DEPENDING ON COUNTS AND FLAGS.
                        /       WHEN THIS IS COMPLETE THE SAME OPERATION IS PERFORMED FOR
                        /       NUMBER TWO.
                        /

              0400              *400

00400   1022  ONEUP,   TAD ONEFLG          /FIRST SEE IF IT'S IN NORMAL SPACE
00401   7450            SNA
00402   5210            JMP ONEOK           /YES IT IS
00403   7001            IAC                 /NO, BUT IS IT JUST COMING OUT?
00404   7450            SNA
00405   1032            TAD ONEFIN          /YES, THROW BACK IN IF ALREADY DESTROYED
00406   3022            DCA ONEFLG          /OTHERWISE JUST COUNT ONE
00407   5752            JMP I ITWOUP        /AND GO TO FIX UP NUMBER TWO

00410   1020  ONEOK,   TAD ONEOUT          /IN NORMAL SPACE - IS IT EXPLODING?
00411   7640            SZA CLA
00412   5237            JMP ONEFIG          /IF YES, ALLOW NO CONTROLS
00413   1045            TAD TWOFIN          /HAS THE ENEMY BEEN VANQUISHED?
00414   7640            SZA CLA
00415   4756            JMS I ONEWN         /YES, SIGNAL VICTORY
00416   1073            TAD INTWRD          /NOW BEGIN TEST OF REQUEST
00417   0354            AND OP300           /LEFT AND RIGHT TURN TOGETHER MEAN HYPERSPACE!
00420   1355            TAD OM300           /TEST BITS 4 AND 5
00421   7640            SZA CLA
00422   5225            JMP ONELEF          /NOPE, CONTINUE
00423   7040            CMA                 /YES, CALL HYPER WITH AC=-1 FOR NUMBER ONE
00424   5476            JMP I HYPER
00425   1073  ONELEF,   TAD INTWRD          /REQUEST FOR LEFT TURN?
00426   0126            AND P200            /TEST BIT 4
00427   7650            SNA CLA
00430   5233            JMP ONERYT          /NO
00431   7340            CLA CLL CMA         /YES DECREMENT ANGLE
00432   5237            JMP ONEFIG

00433   1073  ONERYT,   TAD INTWRD          /HOW ABOUT RIGHT TURN
00434   0124            AND P100            /TEST BIT 5
00435   7640            SZA CLA
00436   7001            IAC                 /YES, INCREMENT ANGLE

00437   1023  ONEFIG,   TAD ONETHE          /PICK UP AND ADJUST ANGLE (MAYBE)
00440   4500            JMS I THEADJ        /BRING BACK WITHIN LIMITS OF TRIG FUNCTIONS
00441   3023            DCA ONETHE          /AND STORE
00442   1023            TAD ONETHE          /FIND THEM TRIG FUNCTIONS
00443   4465            JMS I SINE          /AND STORE ONCE AND FOR ALL
00444   3030            DCA ONESIN          /IN THE APPROPRIATE PLACES
00445   1023            TAD ONETHE
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 438  00446  4466          JMS I COSINE
 439  00447  3031          DCA ONECOS
 440  00450  1020          TAD ONEOUT              /DO NOT ALLOW THRUST IF EXPLODING
 441  00451  7640          SZA CLA
 442  00452  5272          JMP ONEVEL
 443
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00453  1105  ONEMOV, TAD ACCFLG          /ALLOW ANY VELOCITY INCREASE THIS CYCLE?
00454  7640          SZA CLA
00455  5272          JMP ONEVEL          /NOPE
00456  1073          TAD INTWRD          /YES, ANY REQUESTED?
00457  0123          AND P40             /TEST BIT 6
00460  7650          SNA CLA
00461  5272          JMP ONEVEL          /NONE REQUESTED
00462  1031          TAD ONECOS          /YES, ADD IN VELOCITY INCREMENT DEPENDING
00463  1025          TAD ONEVEY          /ON ORIENTATION
00464  4501          JMS I VEESCL        /BUT DO NOT ALLOW TO EXCEED MAXIMUM
00465  3025          DCA ONEVEY          /AND STORE
00466  1030          TAD ONESIN          /DO THE SAME FOR THE OTHER (X) COMPONENT
00467  1024          TAD ONEVEX
00470  4501          JMS I VEESCL
00471  3024          DCA ONEVEX



00472  1024  ONEVEL, TAD ONEVEX          /NOW UPDATE THE POSITION WITH THE
00473  4502          JMS I ISHFT         /VELOCITY COMPONENTS DIVIDED BY 4
00474  4502          JMS I ISHFT         /THIS MAINTAINS MAXIMUM RESOLUTION
00475  1026          TAD ONEPEX
00476  3026          DCA ONEPEX          /IGNORE ANY OVERFLOW
00477  1025          TAD ONEVEY          /DO THE SAME FOR Y COORDINATE
00500  4502          JMS I ISHFT         /AND VELOCITY COMPONENT
00501  4502          JMS I ISHFT
00502  1027          TAD ONEPEY
00503  3027          DCA ONEPEY
00504  1020          TAD ONEOUT          /DO NOT ALLOW PROJECTILE LAUNCH IF
00505  7640          SZA CLA             /EXPLODING
00506  5752          JMP I ITWOUP

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```
 478
 479
 480   00507   1353  ONELNC, TAD LNC1FG              /OTHERWISE, SEE IF RELOAD IS FINISHED
 481   00510   7650          SNA CLA
 482   00511   5314          JMP .+3
 483   00512   2353          ISZ LNC1FG              /NO, CONTINUE RELOADING
 484   00513   5752          JMP I ITWOUP            /AND EXIT
 485   00514   1073          TAD INTWRD              /YES, READY TO LAUNCH, TRIGGER BEEN PULLED?
 486   00515   0121          AND P20                 /TEST BIT7
 487   00516   7650          SNA CLA
 488   00517   5752          JMP I ITWOUP            /NO, WAIT FOR A BETTER SHOT
 489                                                 /.....I GUESS.....
 490   00520   1112          TAD PROLIF              /YES, SET CYCLE COUNT FOR THIS LAUNCH
 491   00521   3416          DCA I AUTO16            /AUTO16 ALWAYS POINTS AT THE NEXT SLOT IN THE FILE
 492   00522   1024          TAD ONEVEX              /ADD SHIPS VELOCITY (SCALED OF COURSE)
 493   00523   4502          JMS I ISHFT             /TO ORIENTATION TO EXTABLISH X VELOCITY
 494   00524   4470          JMS I RSHIFT            /COMPONENT OF PROJECTILE
 495   00525   1030          TAD ONESIN
 496   00526   4470          JMS I RSHIFT            /AND STICK IT IN THE FILE
 497   00527   3416          DCA I AUTO16
 498   00530   1030          TAD ONESIN              /MOVE THE LAUNCH POINT OUTSIDE THE
 499   00531   7106          CLL RTL                 /SHIP OF ORIGIN
 500   00532   1026          TAD ONEPEX
 501   00533   3416          DCA I AUTO16            /AND STORE X POSITION
 502   00534   1025          TAD ONEVEY              /NOW DO THE SAME FOR THE Y VELOCITY AND
 503   00535   4502          JMS I ISHFT             /POSITION
 504   00536   4470          JMS I RSHIFT
 505   00537   1031          TAD ONECOS
 506   00540   4470          JMS I RSHIFT
 507   00541   3416          DCA I AUTO16
 508   00542   1031          TAD ONECOS
 509   00543   7106          CLL RTL
 510   00544   1027          TAD ONEPEY
 511   00545   3416          DCA I AUTO16
 512   00546   1137          TAD M200                /START RELOAD CYCLE
 513   00547   3353          DCA LNC1FG
 514   00550   4503          JMS I RESET1            /RESET AUTO16 TO NEXT HOLE
 515
 516   00551   5752          JMP I .+1               /NOW TO FIX IT UP WITH NUMBER TWO
 517   00552   0600  ITWOUP, TWOUP
 518
 519   00553   0000  LNC1FG, 0                      /PROJECTILE LAUNCH ENABLE
 520
 521   00554   0300  OP300,  300                    /HYPERSPACE REQUEST CODE BITS 4 AND 5
 522   00555   7500  OM300,  -300
 523   00556   2507  ONEWN,  ONEWIN                 /POINTER TO VICTORY MESSAGE
 524
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```
                        /
                        /       HERE BEGINS THE UPDATE PROCEEDURE FOR SHIP NUMBER TWO,
                        /       OPERATION IS THE SAME AS FOR NUMBER ONE ABOVE.
                        /

                0600            *600

00600   1035    TWOUP,  TAD TWOFLG              /FIRST SEE IF IT'S IN NORMAL SPACE
00601   7450            SNA
00602   5210            JMP TWOOK               /YES, CONTINUE
00603   7001            IAC                     /NO, BUMP COUNT AND TEST FOR REENTRY
00604   7450            SNA
00605   1045            TAD TWOFIN              /IF RE-ENTERING THROW BACK OUT IF FINISHED
00606   3035            DCA TWOFLG              /AND CONTINUE
00607   5750            JMP I IONEST

00610   1033    TWOOK,  TAD TWOOUT              /HERE WHEN READY TO UPDATE IN NORMAL SPACE
00611   7640            SZA CLA                 /IS IT EXPLODING?
00612   5235            JMP TWOFIG              /YES DO NOT ALLOW HYPERSPACE
00613   1032            TAD ONEFIN              /DID WE JUST WIN?
00614   7640            SZA CLA
00615   4754            JMS I TWOWN             /YES ENABLE END OF GAME MESSAGE
00616   1073            TAD INTWRD              /TEST FOR HYPERSPACE REQUEST
00617   0352            AND OP14
00620   1353            TAD OM14                /BITS 8 AND 9 MUST BE SET
00621   7650            SNA CLA
00622   5476            JMP I HYPER             /8 AND 9 SET, ENTER HYPER ROUTINE WITH AC=0
                                                /FOR SHIP NUMBER 2
00623   1073    TWOLEF, TAD INTWRD              /TEST FOR LEFT TURN - BIT 8
00624   0117            AND P10
00625   7650            SNA CLA
00626   5231            JMP TWORYT              /NOT SET
00627   7340            CLA CLL CMA             /SET, DECREMENT TWOTHE BY 1 DEGREE
00630   5235            JMP TWOFIG              /SKIP TEST FOR RIGHT TURN

00631   7307    TWORYT, CLA CLL IAC RTL         /TEST FOR RIGHT TURN - BIT 9
00632   0073            AND INTWRD
00633   7640            SZA CLA
00634   7001            IAC                     /IF SET INCREMENT TWOTHE BY 1 DEGREE

00635   1036    TWOFIG, TAD TWOTHE              /UPDTAE TWOTHE
00636   4500            JMS I THEADJ            /BRING TO WITHIN LIMITS OF SINE,COSINE
00637   3036            DCA TWOTHE              /AND STORE
00640   1036            TAD TWOTHE
00641   4465            JMS I SINE              /CALCULATE SINE AND COSINE FUNCTIONS
00642   3043            DCA TWOSIN              /AND STORE IN DATA TABLE
00643   1036            TAD TWOTHE
00644   4466            JMS I COSINE
00645   3044            DCA TWOCOS
00646   1033            TAD TWOOUT              /DO NOT ALLOW VELOCITY CHANGE IF EXPLODING
00647   7640            SZA CLA
00650   5270            JMP TWOVEL
```

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579
580
581   00651  1105  TWOMOV, TAD ACCFLG              /NOW FOR ACCELERATION.  TEST TO SEE IF ALLOWED
582   00652  7640          SZA CLA                  /DURING THIS UPDATE CYCLE
583   00653  5270          JMP TWOVEL               /NOPE
584   00654  7105          CLL IAC RAL              /YES, TEST FOR BIT 2 SET
585   00655  0073          AND INTWRD
586   00656  7650          SNA CLA
587   00657  5270          JMP TWOVEL               /NOT SET
588
589   00660  1043          TAD TWOSIN               /UPDATE X VELOCITY COMPONENT BY SINE OF
590   00661  1037          TAD TWOVEX               /ANGLE OF ORIENTATION
591   00662  4501          JMS I VEESCL             /AND SCALE TO NOT EXCEED MAX
592   00663  3037          DCA TWOVEX               /UPDATE Y COMPONENT WITH COSINE
593
594   00664  1044          TAD TWOCOS
595   00665  1040          TAD TWOVEY
596   00666  4501          JMS I VEESCL
597   00667  3040          DCA TWOVEY
598
599
600
601   00670  1037  TWOVEL, TAD TWOVEX               /NOW UPDATE THE POSITION WITH THE VELOCITY
602   00671  4502          JMS I ISHFT              /COMPONENTS/16
603   00672  4502          JMS I ISHFT
604   00673  1041          TAD TWOPEX
605   00674  3041          DCA TWOPEX
606   00675  1040          TAD TWOVEY
607   00676  4502          JMS I ISHFT
608   00677  4502          JMS I ISHFT
609   00700  1042          TAD TWOPEY
610   00701  3042          DCA TWOPEY
611   00702  1033          TAD TWOOUT
612   00703  7640          SZA CLA
613   00704  5750          JMP I IONEST
614
```

```
 615
 616
 617   00705  1351  TWOLNC, TAD LNC2FG              /NOW CHECK FOR PROJECTILE LAUNCH, FIRST
 618   00706  7650          SNA CLA                  /TEST TO SEE IF RELOAD COMPLETE
 619   00707  5312          JMP .+3
 620   00710  2351          ISZ LNC2FG               /NO, COUNT ONE CYCLE AND EXIT
 621   00711  5750          JMP I IONEST
 622   00712  7001          IAC                      /YES, TEST TRIGGER BIT 11
 623   00713  0073          AND INTWRD
 624   00714  7650          SNA CLA
 625   00715  5750          JMP I IONEST             /NOT SET, HELL WITH IT
 626
 627   00716  1112          TAD PROLIF               /OK, SET PROJECTILE LIFE
 628   00717  3416          DCA I AUTO16             /AUTO16 IS ALWAYS POINTING AT THE NEXT SLOT
 629   00720  1037          TAD TWOVEX               /ADD SHIPS VELOCITY
 630   00721  4502          JMS I ISHFT              /(ADJUSTED)
 631   00722  4470          JMS I RSHIFT
 632   00723  1043          TAD TWOSIN               /TO THAT OF PROJECTILE  = AGAIN X COMPONENT
 633   00724  4470          JMS I RSHIFT             /FROM SINE OF ANGLE OF ORIENTATION
 634   00725  3416          DCA I AUTO16
 635   00726  1043          TAD TWOSIN               /SET INITIAL POSITION TO BE JUST AHEAD
 636   00727  7106          CLL RTL                  /OF THE SHIP
 637   00730  1041          TAD TWOPEX               /X COMPONENT
 638   00731  3416          DCA I AUTO16
 639   00732  1040          TAD TWOVEY               /NOW THE Y COMPONENTS FROM Y VELOCITY
 640   00733  4502          JMS I ISHFT              /Y POSITION AND COSINE
 641   00734  4470          JMS I RSHIFT
 642   00735  1044          TAD TWOCOS
 643   00736  4470          JMS I RSHIFT
 644   00737  3416          DCA I AUTO16
 645   00740  1044          TAD TWOCOS
 646   00741  7106          CLL RTL
 647   00742  1042          TAD TWOPEY
 648   00743  3416          DCA I AUTO16
 649   00744  1137          TAD M200
 650   00745  3351          DCA LNC2FG               /200 CYCLES OF RELOAD
 651   00746  4503          JMS I RESET1             /DRINK LEADEN DEATH, NUMBER ONE!
 652
 653   00747  5750          JMP I .+1                /FINAL EXIT TO DISPLAY FILE CALCULATIONS
 654   00750  1000  IONEST, ONESET
 655
 656   00751  0000  LNC2FG, 0                       /RELOAD COUNT
 657
 658   00752  0014  OP14,   14                      /HYPERSPACE CODE
 659   00753  7764  OM14,   -14
 660   00754  2515  TWOWN,  TWOWIN
 661
```

```
                                /
                                /       HERE BEGINS THE DISPLAY CALCULATIONS FOR THE TWO SHIPS.  AT
                                /       THIS POINT ONLY THE POSITION AND ORIENTATION OF EACH VESSEL
                                /       IS ONF INTEREST SINCE THE VELOCITY AND ALL THAT HAVE ALREADY
                                /       BEEN TAKEN CARE OF.  FOR THE BOTH SHIPS THE DISPLAY FILES ARE
                                /       CALCULATED AS A SERIES OF PAIRS OF X,Y COORDINATES.  BETWEEN
                                /       EACH PAIR OF POINTS A FOUR POINT VECTOR WILL BE DRAWN.  THE
                                /       ACTUAL COORDINATES ARE CALCULATED AS DISPLACEMENTS
                                /       FROM THE CENTRAL PSOTION OF THE SHIP, TAKING INTO ACCOUNT THE
                                /       ANGLE OF ORIENTATION.  THE FORMULAS FOLLOWED ARE:
                                /
                                /       X(POINT)=X(BASE)+X(REL)*COS(THE)+Y(REL)*SINE(THE)
                                /
                                /       Y(POINT)=Y(BASE)+Y(REL)*COS(THE)-X(REL)*SINE(THE)
                                /
                                /       WHERE SINE(THE) AND COS(THE) ARE THE FUNCTIONS OF THE
                                /       ANGLE OF ORIENTATION, X(BASE) AND Y(BASE) ARE THE
                                /       COORDINATES OF THE SHIPS POSITION AND X(REL) AND Y(REL)
                                /       CORRESPOND TO DISPLACEMENT PAIRS DEPENDING ON THE SHAPE
                                /       OF THE FIGURE.  ALL X AND Y RELS LIE WITHIN THE RANGE 0-3 AND
                                /       THERE FORE ALL NECESSARY DISPLACEMENTS FROM BASE COORDINATES
                                /       MAY BE CALCULATEDFROM DIFFERENT COMBINATIONS OF T10SIN, T20COS
                                /       ETC.  THESE VALUES ARE CALCULATED BY A CALL TO POSCAL WITH THE SINE
                                /       AND COSINE OF THE ANGLE OF INTEREST IN CALSIN AND CALCOS.
                                /
                                /       FOLLOWING THIS METHOD ANY FIGURE DESCRIBABLE WITH A 7 BY 7
                                /       MATRIX OF POINTS MAY BE QUICKLY CALCULATED.
                                /
                                /       BEGINNING AT ONESET DIFFERENT DISPLACEMENT PAIRS ARE CALCULATED
                                /       AND DEPOSITIED THROUGH AUTO10 TO FORM THE DISPLAY FILE FOR SHIP NUMBER ONE.
                                /

                        1000            *1000

01000   7300    ONESET, CLA CLL                 /BEGIN DISPLAY FILE FOR NUMBER ONE
01001   1022            TAD ONEFLG              /DONT BOTHER IF NOT IN NORMAL SPACE
01002   7640            SZA CLA
01003   5753            JMP I ITWOST
01004   1030            TAD ONESIN              /SET UP FOR MATRIX COMPONENT CALCULATIONS
01005   3063            DCA CALSIN
01006   1031            TAD ONECOS
01007   3064            DCA CALCOS
01010   4472            JMS I CALPOS            /CALL THE CALCULATOR

                        /
                        /       CONSIDER THE 7 BY 7 MATRIX OF DISPLACEMENT POINTS WITH THE
                        /       CENTER AT 0,0 CORRESPONDING TO THE SHIPS POSITION.  A SERIES
                        /       OF POINTS IS NOW DESCRIBED AROUND THIS CENTER USING THE
                        /       MULTIPLES OF THE TRIG FUNCTIONS JUST CALCULATED
                        /       SO THAT ANY POINT ON THE OUTLINE IS DESCRIBABLE AS X,Y
                        /       DISPLACED BY X,Y OF THE SHIP ITSELF
                        /
```

```
 717  01011  1114          TAD ONEFIL              /SET UP AUTO10 AS THE DISPLAY FILE
 718  01012  3010          DCA AUTO10              /POINTER
 719  01013  1026          TAD ONEPEX              /THE FIRST POINT OF THE OUTLINE IS
 720  01014  1057          TAD T30SIN
 721  01015  3410          DCA I AUTO10            /       0,3     OR TOP CENTER
 722  01016  1027          TAD ONEPEY
 723  01017  1062          TAD T30COS
 724  01020  3410          DCA I AUTO10
 725
 726  01021  1060          TAD T10COS
 727  01022  7041          CIA                     /THE SECOND IS
 728  01023  1026          TAD ONEPEX
 729  01024  3410          DCA I AUTO10            /       -1,0
 730  01025  1055          TAD T10SIN              /OR JUST LEFT OF DEAD CENTER
 731  01026  1027          TAD ONEPEY              /AND SO ON
 732  01027  3410          DCA I AUTO10
 733
 734  01030  1057          TAD T30SIN
 735  01031  1062          TAD T30COS              /THE THIRD POINT IS
 736  01032  7041          CIA
 737  01033  1026          TAD ONEPEX              /       -3,-3
 738  01034  3410          DCA I AUTO10
 739  01035  1062          TAD T30COS              /OR BOTTOM LEFT HAND CORNER
 740  01036  7041          CIA
 741  01037  1057          TAD T30SIN
 742  01040  1027          TAD ONEPEY
 743  01041  3410          DCA I AUTO10
 744
```

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 745
 746
 747   01042  1055          TAD T10SIN
 748   01043  7041          CIA                     /FOURTH POINT
 749   01044  1026          TAD ONEPEX
 750   01045  3410          DCA I AUTO10            /       0,-1
 751   01046  1060          TAD T10COS
 752   01047  7041          CIA                     /OR JUST BELOW CENTER
 753   01050  1027          TAD ONEPEY
 754   01051  3410          DCA I AUTO10
 755
 756   01052  1073  FLAM1,  TAD INTWRO              /TEST FOR POWER ON, IF ON, DRAW THE
 757   01053  0123          AND P40                 /FLAME WITH AN EXTRA POINT SOME
 758   01054  7650          SNA CLA                 /DISTANCE DIRECTLY BELOW THE SHIP
 759   01055  5321          JMP ONECON              /POWER NOT ON - CONTINUE
 760   01056  1020          TAD ONEOUT              /DO NOT ALLOW IF EXPLODING
 761   01057  7640          SZA CLA
 762   01060  5321          JMP ONECON
 763
 764   01061  1354          TAD ONFG1               /USE ONFG1 TO TURN THE FLAME ON AND
 765   01062  7450          SNA                     /OFF TO MAKE IT FLICKER,  DISPLAY THE
 766   01063  7344          CLA CLL CMA RAL         /FLAME ONE TIME OUT OF THREE
 767   01064  3354          DCA ONFG1
 768
 769   01065  2354          ISZ ONFG1
 770   01066  5321          JMP ONECON              /ONE OUT OF THREE TIMES THIS WILL SKIP
 771
 772   01067  1355          TAD ONFG2               /VARY ALSO THE LENGHT OF THE FLAME
 773   01070  7040          CMA                     /WITH LONG SHORT LONG SHORT
 774   01071  3355          DCA ONFG2
 775
 776   01072  1355          TAD ONFG2               /TIP OF FLAME AT EITHER
 777   01073  7650          SNA CLA
 778   01074  1055          TAD T10SIN              /       0,-4    OR
 779   01075  1057          TAD T30SIN              /       0,-3
 780   01076  7041          CIA
 781   01077  1026          TAD ONEPEX
 782   01100  3410          DCA I AUTO10
 783   01101  1355          TAD ONFG2
 784   01102  7650          SNA CLA
 785   01103  1060          TAD T10COS
 786   01104  1062          TAD T30COS
 787   01105  7041          CIA
 788   01106  1027          TAD ONEPEY
 789   01107  3410          DCA I AUTO10
 790
 791   01110  1055          TAD T10SIN
 792   01111  7041          CIA
 793   01112  1026          TAD ONEPEX              /RETURN DISPLAY TO 0,-1
 794   01113  3410          DCA I AUTO10
 795   01114  1060          TAD T10COS
 796   01115  7041          CIA
 797   01116  1027          TAD ONEPEY
 798   01117  3410          DCA I AUTO10
 799   01120  7344          CLA CLL CMA RAL         /ADD -2 TO POINT COUNT
```

800

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 801
 802
 803  01121  1133  ONECON, TAD M6                /SET POINT COUNT TO -6 OR -8
 804  01122  3021         DCA ONECNT
 805
 806  01123  1057         TAD T30SIN             /CONTINUE WITH DISPLAY FILE - THIS POINT
 807  01124  7041         CIA
 808  01125  1062         TAD T30COS             /       AT 3,-3
 809  01126  1026         TAD ONEPEX             /
 810  01127  3410         DCA I AUTO10           /OR LOWER RIGHT HAND CORNER
 811  01130  1057         TAD T30SIN
 812  01131  1062         TAD T30COS
 813  01132  7041         CIA
 814  01133  1027         TAD ONEPEY
 815  01134  3410         DCA I AUTO10
 816
 817  01135  1060         TAD T10COS             /NEXT
 818  01136  1026         TAD ONEPEX             /
 819  01137  3410         DCA I AUTO10           /       1,0
 820  01140  1055         TAD T10SIN             /
 821  01141  7041         CIA                    / OR JUST RIGHT OF CENTER
 822  01142  1027         TAD ONEPEY
 823  01143  3410         DCA I AUTO10
 824
 825  01144  1057         TAD T30SIN             /FINALLY BACK TO
 826  01145  1026         TAD ONEPEX             /
 827  01146  3410         DCA I AUTO10           /       0,3
 828  01147  1062         TAD T30COS             /
 829  01150  1027         TAD ONEPEY             / TOP CENTE
 830  01151  3410         DCA I AUTO10
 831
 832  01152  5753         JMP I ITWOST           /NOW FOR NUMBER TWO
 833  01153  1200  ITWOST, TWOSET
 834
 835  01154  0000  ONFG1,  0                     /USED TO COUNT FLICKERS
 836  01155  0000  ONFG2,  0                     /SHORT OR LONG FLAG
 837
```

```
                        /
                        /       HERE BEGINS THE DISPLAY FILE GENERATOR FOR SHIP TWO.
                        /       IT WORKS JUST LIKE THE ONE FOR NUMBER ONE BUT WITH
                        /       DIFFERENT DISPLACEMENT PAIRS AND TWO EXTRA POINTS
                        /

                1200            *1200

01200   7300    TWOSET, CLA CLL                 /DONT BOTHER IF NOT IN NORMAL SPACE
01201   1035            TAD TWOFLG
01202   7640            SZA CLA
01203   5775            JMP I IFILDS
01204   1043            TAD TWOSIN              /SET UP TO HAVE DISPLACEMENT INCREMENTS
01205   3063            DCA CALSIN              /CALCULATED
01206   1044            TAD TWOCOS
01207   3064            DCA CALCOS
01210   4472            JMS I CALPOS

01211   1115            TAD TWOFIL              /SET AUTO10 TO POINT TO SECOND DISPLAY
01212   3010            DCA AUTO10              /FILE
01213   1057            TAD T30SIN              /FIRST POINT AT
01214   1041            TAD TWOPEX              /
01215   3410            DCA I AUTO10            /       0,3
01216   1062            TAD T30COS              /
01217   1042            TAD TWOPEY              / OR TOP CENTER
01220   3410            DCA I AUTO10

01221   1061            TAD T20COS
01222   7041            CIA
01223   1056            TAD T20SIN
01224   1041            TAD TWOPEX
01225   3410            DCA I AUTO10
01226   1056            TAD T20SIN
01227   1061            TAD T20COS              /SECOND POINT
01230   1042            TAD TWOPEY              /       -2,2
01231   3410            DCA I AUTO10

01232   1061            TAD T20COS              /THIRD POINT
01233   7041            CIA                     /       -2,0
01234   1041            TAD TWOPEX
01235   3410            DCA I AUTO10
01236   1056            TAD T20SIN
01237   1042            TAD TWOPEY
01240   3410            DCA I AUTO10


01241   1061            TAD T20COS
01242   1057            TAD T30SIN
01243   7041            CIA
01244   1041            TAD TWOPEX              /FOURTH POINT
01245   3410            DCA I AUTO10            /       -2,-3
01246   1062            TAD T30COS
01247   7041            CIA
```

```
 893   01250  1056          TAD T20SIN
 894   01251  1042          TAD TWOPEY
 895   01252  3410          DCA I AUTO10
 896
```

```
897
898
899   01253  1056          TAD T20SIN
900   01254  7041          CIA                     /NEXT
901   01255  1041          TAD TWOPEX              /       0,-2
902   01256  3410          DCA I AUTO10
903   01257  1061          TAD T20COS
904   01260  7041          CIA
905   01261  1042          TAD TWOPEY
906   01262  3410          DCA I AUTO10
907
908   01263  7305  FLAM2,  CLA CLL IAC RAL         /NOW THE FLAME BIT, CHECK FOR POWER ON
909   01264  0073          AND INTWRD
910   01265  7650          SNA CLA
911   01266  5332          JMP TWOCON              /NO, FORGET IT
912   01267  1033          TAD TWOOUT              /NOT ALLOWED IF EXPLODING
913   01270  7640          SZA CLA
914   01271  5332          JMP TWOCON
915
916   01272  1376          TAD TWFG1               /SET THE 1-3 FLICKER AS WITH #1
917   01273  7450          SNA
918   01274  7344          CLA CLL CMA RAL
919   01275  3376          DCA TWFG1
920
921   01276  2376          ISZ TWFG1               /ALSO THE LENGHT VARIATION
922   01277  5332          JMP TWOCON
923
924   01300  1377          TAD TWFG2               /EVERY OTHER TIME LONG
925   01301  7040          CMA
926   01302  3377          DCA TWFG2
927                                                /FLAME TIP AT EITHER
928   01303  1377          TAD TWFG2               /       0,-3
929   01304  7650          SNA CLA                 /OR
930   01305  1056          TAD T20SIN              /       0,-5
931   01306  1057          TAD T30SIN
932   01307  7041          CIA
933   01310  1041          TAD TWOPEX
934   01311  3410          DCA I AUTO10
935   01312  1377          TAD TWFG2
936   01313  7650          SNA CLA
937   01314  1061          TAD T20COS
938   01315  1062          TAD T30COS
939   01316  7041          CIA
940   01317  1042          TAD TWOPEY
941   01320  3410          DCA I AUTO10
942
943   01321  1056          TAD T20SIN              /NOW BACK UP TO THE SHIP
944   01322  7041          CIA
945   01323  1041          TAD TWOPEX
946   01324  3410          DCA I AUTO10
947   01325  1061          TAD T20COS
948   01326  7041          CIA
949   01327  1042          TAD TWOPEY
950   01330  3410          DCA I AUTO10
951
```

```
 952   01331  7344          CLA CLL CMA RAL          /ADD -2 TO POINT COUNT
 953
```

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01332 1134 TWOCON, TAD M10          /SET POINT COUNT TO -8 OR -10
01333 3034         DCA TWOCNT

01334 1057         TAD T30SIN       /CONTINUE WITH DISPLAY FILE
01335 7041         CIA              /NEXT POINT AT 2,-3
01336 1061         TAD T20COS
01337 1041         TAD TWOPEX
01340 3410         DCA I AUTO10
01341 1062         TAD T30COS
01342 1056         TAD T20SIN
01343 7041         CIA
01344 1042         TAD TWOPEY
01345 3410         DCA I AUTO10



01346 1061         TAD T20COS       /NEXT POINT
01347 1041         TAD TWOPEX       /
01350 3410         DCA I AUTO10     /       2,0
01351 1056         TAD T20SIN
01352 7041         CIA
01353 1042         TAD TWOPEY
01354 3410         DCA I AUTO10

01355 1061         TAD T20COS       /AND THE NEXT AT
01356 1056         TAD T20SIN
01357 1041         TAD TWOPEX       /       2,2
01360 3410         DCA I AUTO10
01361 1056         TAD T20SIN
01362 7041         CIA
01363 1061         TAD T20COS
01364 1042         TAD TWOPEY
01365 3410         DCA I AUTO10

01366 1057         TAD T30SIN
01367 1041         TAD TWOPEX
01370 3410         DCA I AUTO10
01371 1062         TAD T30COS       /AND THE LAST AT
01372 1042         TAD TWOPEY       /
01373 3410         DCA I AUTO10     /       0,3

01374 5775         JMP I IFILDS     /NOW TO DISPLAY THE WHOLE MESS
01375 1400 IFILDS, FILDIS

01376 0000 TWFG1,  0                /FLIK THE FLAME
01377 0000 TWFG2,  0                /LONG OR SHORT

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```
1003
1004                    /
1005                    /       HERE TO DISPLAY THE TWO SHIPS.  CHECK FIRST FOR COLLISION
1006                    /       AND THEN SET THE TWO PAIRS OF COORDENATES FOR THE END
1007                    /       POINTS AND CALL THE "VECTOR GENERATOR" TO DRAW THE DOTS
1008                    /       IN BETWEEN.  WHEN THE COUNT OVERFLOWS DO THE SAME FOR
1009                    /       NUMBER TWO.  THEN EXIT TO DISPLAY ALL THE PROJECTILES.
1010                    /
1011
1012            1400            *1400
1013
1014    01400   7300    FILDIS, CLA CLL                 /ALL SET TO GO
1015    01401   4672            JMS I COLIDE            /TEST FOR COLLISION FIRST
1016    01402   6325            DSB 1                   /IF NO COLLISION
1017    01403   1022            TAD ONEFLG              /SKIP NUMBER ONE IF NOT IN NORMAL
1018    01404   7640            SZA CLA                 /SPACE
1019    01405   5236            JMP TWODIS
1020
1021    01406   1114            TAD ONEFIL              /SET UP POINTERS TO DISPLAY FILE
1022    01407   3010            DCA AUTO10              /FOR NUMBER ONE
1023    01410   1021            TAD ONECNT              /ALONG WITH VECTOR COUNT
1024    01411   3011            DCA AUTO11
1025    01412   1410            TAD I AUTO10            /SET OUT THE FIRST POINT PAIR
1026    01413   3046            DCA XONEDS
1027    01414   1410            TAD I AUTO10
1028    01415   3047            DCA YONEDS
1029    01416   1020            TAD ONEOUT              /NORMAL DISPLAY OR EXPLOSION?
1030    01417   7640            SZA CLA
1031    01420   5673            JMP I IONEEX            /GO ELSE WHERE FOR EXPLOSION
1032
1033    01421   1410    FILONE, TAD I AUTO10            /STEP TO NEXT PAIR OF POINTS
1034    01422   3050            DCA XTWODS              /SET X AND Y TO NEW POINT
1035    01423   1410            TAD I AUTO10
1036    01424   3051            DCA YTWODS
1037    01425   4471            JMS I VECTOR            /CALL THE DOT DRAWING MACHINE
1038    01426   2011            ISZ AUTO11
1039    01427   7410            SKP                     /COUNT
1040    01430   5236            JMP TWODIS              /DO NUMBER TWO ON OVERFLOW
1041    01431   1050            TAD XTWODS              /SWAP POINTS FOR NEXT PAIR
1042    01432   3046            DCA XONEDS
1043    01433   1051            TAD YTWODS              /THE GENERATOR DRAWS FROM ONE
1044    01434   3047            DCA YONEDS              /TOWARDS TWO
1045    01435   5221            JMP FILONE
1046
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1019   1436      TWODIS,   TAD TWOFLG
1050     37                SZA CLA
1051   1440                JMP I IPRODS
1053     41                TAD TWOFIL
1054     42                DCA AUTO10
1055     43                TAD TWOCNT
1056     44                DCA AUTO11
1057     45                TAD I AUTO10
1058     46                DCA XONEDS
1059     47                TAD I AUTO10
1060   1450                DCA YONEDS
1061     51                TAD TWOOUT
1062     52                SZA CLA
1063     53                JMP I ITWOEX
1065     54      TWDLOP,   TAD I AUTO10
1066     55                DCA XTWODS
1067     56                TAD I AUTO10
1068     57                DCA YTWODS
1069   1460                JMS I VECTOR
1070     61                ISZ AUTO11
1071     62                JMP .+3
         63                JMP I.1
1074     64      IPRODS,   PRODIS
1076     65                TAD XTWODS
1077     66                DCA YONEDS
1078     67                TAD YTWODS
1079   1470                DCA YONEDS
1080     71                JMP TWDLOP
1082     72      COLIDE,   COLLID
1083     73      IONEEX,   ONEEXP
1084     74      ITWOEX,   TWOEXP
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1086
1087                    /
1088                    /       THIS IS THE SO CALLED "VECTOR GENERATOR" WHICH DRAWS A
1089                    /       SERIES OF DOTS FROM XONEDS,YONEDS TO XTWODS,YTWODS.
1090                    /       THE COORDINATE COMPONENTS ARE DIVIDED INTO FOURTHS  AND
1091                    /       FOUR DOTS DRAWN ON THE SCOPE SCREEN.  NOTE THAT NO DOT
1092                    /       IS DRAWN AT XONEDS,YONEDS.  THIS IS COMPENSATED FOR ELSEWHERE.
1093                    /
1094
1095
1096    01475   0000    DISPLY, 0                       /ENTER TO DRAW A FOUR POINT VECTOR
1097    01476   1046            TAD XONEDS              /FROM XONEDS,YONEDS
1098    01477   7041            CIA                     /TO XTWODS,YTWODS
1099    01500   1050            TAD XTWODS              /DIVIDE COORDINATE DIFERENCES INTO
1100    01501   4335            JMS DISHFT              /FOURTHS
1101    01502   3052            DCA DIXTEM              /AND STORE INCREMENT
1102    01503   1047            TAD YONEDS
1103    01504   7041            CIA
1104    01505   1051            TAD YTWODS
1105    01506   4335            JMS DISHFT
1106    01507   3053            DCA DIYTEM
1107    01510   1132            TAD M4                  /FOR FOUR DOTS
1108    01511   3054            DCA DISCNT
1109
1110    01512   1046    DISLOP, TAD XONEDS              /ADD INCREMENT TO CURRENT X AND Y
1111    01513   1052            TAD DIXTEM
1112    01514   3046            DCA XONEDS              /NOTE THAT THIS ROUTINE DESTROYS
1113    01515   1047            TAD YONEDS              /XONEDS AND YONEDS
1114    01516   1053            TAD DIYTEM
1115    01517   3047            DCA YONEDS
1116    01520   1046            TAD XONEDS
1117    01521   7012            RTR                     /DIVIDE BY 8 TO FIT SCREEN SIZE
1118    01522   7010            RAR
1119    01523   6303            DXC DXL                 /SET X VALUE
1120    01524   7200            CLA
1121    01525   1047            TAD YONEDS              /DO THE SAME FOR Y
1122    01526   7012            RTR
1123    01527   7010            RAR
1124    01530   6317            DYC DYL DIS             /AT LAST SOMETHING TO SEE!!
1125    01531   7200            CLA
1126    01532   2054            ISZ DISCNT              /DONE YET?
1127    01533   5312            JMP DISLOP              /NOPE
1128    01534   5675            JMP I DISPLY            /YUP
1129
1130
1131    01535   0000    DISHFT, 0                       /A GENERALIZED SHIFT ROUTINE CALLED
1132    01536   7100            CLL                     /FROM EVERYWHERE TO DIVIDE THE
1133    01537   7510            SPA                     /AC BY FOUR WITH AN ASR RIGHT
1134    01540   7021            CML IAC                 /NOTE THAT NEGATIVE NUMBERS ARE
1135    01541   7010            RAR                     /ROUNDED UPWARDS (TOWARD ZERO)
1136    01542   7100            CLL                     /TO MAKE IT COME OUT RIGHT
1137    01543   7510            SPA
1138    01544   7021            CML IAC                 /EVEN SO THERE ARE SOME ROUNDING ERRORS
1139    01545   7010            RAR                     /SOMEWHERE.  SO MUCH FOR 12 BIT MACHINES
1140    01546   5735            JMP I DISHFT
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1141

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1142
1143                    /
1144                    /       HERE TO DISPLAY ALL THE PROJECTILES AND TEST FOR HITS.
1145                    /       THE PROJECTILE DISPLAY FILE IS SEARCHED FOR PROJECTILES WITH
1146                    /       NON-ZERO COUNTS AND WHEN ONE IS FOUND THE POSITION IS
1147                    /       UPDATED BY THE VELOCITY, THE POINT DISPLAYED AND TESTED FOR
1148                    /       A HIT.
1149                    /
1150
1151            1600            *1600
1152
1153    01600   7300    PRODIS, CLA CLL                 / BEGIN DISPLAY OF THE PROJECTILES
1154    01601   1272            TAD BUFST               /POINT TO BEGINNING OF DISPLAY FILE
1155    01602   3113            DCA BUFTMP
1156    01603   6326            DSB 2                   /SET EXTRA BRIGHT FOR SINGLE POINTS
1157
1158    01604   1513    PROLOP, TAD I BUFTMP            /PICK UP NEXT COUNT
1159    01605   7450            SNA
1160    01606   5262            JMP EXPIRE              /THIS ONE IS DEAD - GO TO THE NEXT
1161    01607   7001            IAC                     /INCREMENT COUNT AND REPLACE
1162    01610   3513            DCA I BUFTMP
1163    01611   2113            ISZ BUFTMP              /BUMP POINTER TO X VELOCITY
1164    01612   1513            TAD I BUFTMP
1165    01613   2113            ISZ BUFTMP              /THEN TO XPOSITION AND UPDATE X POSITION
1166    01614   1513            TAD I BUFTMP            /WITH THE VELOCITY WHICH IS CONSTANT
1167    01615   3513            DCA I BUF\..P
1168    01616   1513            TAD I BUFTMP
1169    01617   3110            DCA PROX                /AND STORE X POSITION FOR DISPLAY AND TEST
1170    01620   2113            ISZ BUFTMP              /NOW TO Y POSITION AND VELOCITY
1171    01621   1513            TAD I BUFTMP
1172    01622   2113            ISZ BUFTMP
1173    01623   1513            TAD I BUFTMP            /SAME LITTLE GAME
1174    01624   3513            DCA I BUFTMP
1175    01625   1513            TAD I BUFTMP
1176    01626   3111            DCA PROY                /STORE THE NEW Y VALUE
1177
1178    01627   1110            TAD PROX                /DISPLAY THE POINT WITH
1179    01630   7012            RTR                     /THE SAME SHIFT AS FOR THE SHIPS
1180    01631   7010            RAR                     /FOR THE SMALL SCREEN
1181    01632   6303            DXC DXL
1182    01633   7200            CLA
1183    01634   1111            TAD PROY
1184    01635   7012            RTR                     /
1185    01636   7010            RAR
1186    01637   6317            DYC DYL DIS             /THERE IT IS!!
1187    01640   7200            CLA
1188    01641   4674            JMS I CHKOUT            /TEST  FOR A HIT
1189    01642   2113            ISZ BUFTMP              /MOVE POINTER ON AND TEST FOR END
1190    01643   1113            TAD BUFTMP              /OF BUFFER
1191    01644   1273            TAD BUFLIM
1192    01645   7640            SZA CLA
1193    01646   5204            JMP PROLOP              /NOT AT END - CONTINUE
1194
```

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1195                    /
1196                    /       HERE AT THE END OF THE PROJECTILE DISPLAY,  IF THE GAMOVR
1197                    /       FLAG IS SET, GO ON TO THE MESSAGE DISPLAY - VICTORY LAP
1198                    /       SECTION.  OTHERWISE PICK UP THE REMAINING CLOCK COUNT
1199                    /       TO GIVE THE FANS SOMETHING TO LOOK AT, AND MOVE THE
1200                    /       ELECTRON BEAM TO A LOWER CORNER,  THE COUNT DISPLAYED
1201                    /       IN THE AC IS THE NUMBER OF 100 USEC CLOCK TICKS REMAINING
1202                    /       WHEN THIS CODE IS REACHED BEFORE THE NEXT UPDATE WOULD
1203                    /       BEGIN.  TURNS OUT THAT ROUGHLY 2/3 OF THE CPU IS LEFT
1204                    /       OVER SHOULD ANYONE WANT TO DO ANYTHING VERY FANCY.
1205                    /
1206
1207
1208    01647   1104    FINISH, TAD GAMOVR              /IS THIS THE VICTORY LAP OR WHAT?
1209    01650   7640            SZA CLA
1210    01651   5661            JMP I ENDGAM            /YES, GO TO PUT UP THE MESSAGE
1211    01652   1140            TAD M400                /MOVE THE BEAM OFF SCREEN
1212    01653   6313            DYC DYL
1213    01654   7300            CLA CLL
1214    01655   6303            DXC DXL
1215    01656   1074            TAD INTCNT              /PICK UP THE COUNT
1216    01657   7041            CIA
1217    01660   5260            JMP .
1218
1219    01661   2527    ENDGAM, JOBLOP
1220
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1221
1222
1223  01662  1113  EXPIRE, TAD BUFTMP          /HERE TO ADVANCE THE BUFFER
1224  01663  1116          TAD P5              /POINTER TO THE NEXT PROJECTILE
1225  01664  3113          DCA BUFTMP          /UNLESS THE END
1226  01665  1113          TAD BUFTMP          /OF THE BUFFER
1227  01666  1273          TAD BUFLIM          /IS REACHED
1228  01667  7640          SZA CLA             /IN WHICH CASE
1229  01670  5204          JMP PROLOP          /IT
1230  01671  5247          JMP FINISH          /QUITS
1231
1232  01672  7501  BUFST,  DISBUF+101
1233  01673  0203  BUFLIM, -DISBUF-175
1234  01674  2000  CHKOUT, CHECK
1235
1236  01675  0000  RESE1,  0                   /THIS IS CALLED TO SET THE POINTER
1237  01676  1323          TAD MRES            /(AUTO16) TO THE NEXT FREE SLOT
1238  01677  3324          DCA RESCNT          /FOR A PROJECTILE LAUNCH, 12 POSSIBLE
1239
1240  01700  1325  RESLOP, TAD RESPNT          /MOVE THE POINTER TO THE NEXT SLOT
1241  01701  1116          TAD P5
1242  01702  3325          DCA RESPNT
1243  01703  1325          TAD RESPNT          /RESTE IF AT END OF BUFFER
1244  01704  1273          TAD BUFLIM
1245  01705  7640          SZA CLA
1246  01706  5311          JMP RESCON
1247  01707  1272          TAD BUFST
1248  01710  3325          DCA RESPNT
1249
1250  01711  1725  RESCON, TAD I RESPNT       /FIND A HOLE YET?
1251  01712  7650          SNA CLA
1252  01713  5317          JMP RESFND          /YES, SET UP AUTO16
1253  01714  2324          ISZ RESCNT          /NO COUNT
1254  01715  5300          JMP RESLOP          /AND TRY AGAIN
1255  01716  7402          HLT                 /NO HOLES AT ALL?
1256
1257  01717  7040  RESFND, CMA                 /BACK THE POINTER FOR AUTO INDEXING
1258  01720  1325          TAD RESPNT
1259  01721  3016          DCA AUTO16
1260  01722  5675          JMP I RESE1
1261
1262  01723  7764  MRES,   -14
1263  01724  0000  RESCNT, 0
1264  01725  0000  RESPNT, 0
1265
1266  01726  0000  SETBUF, 0
1267  01727  7040          CMA                 /THIS ROUTINE IS CALLED FROM THE
1268  01730  1272          TAD BUFST           /STARTING SEQUENCE TO INITIALIZE ALL
1269  01731  3016          DCA AUTO16          /THE BUFFER POINTERS AND SO ON
1270  01732  1272          TAD BUFST
1271  01733  3113          DCA BUFTMP
1272  01734  1272          TAD BUFST
1273  01735  3325          DCA RESPNT
1274  01736  1272          TAD BUFST
1275  01737  3347          DCA SETPNT
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1276   01740  3747  SETLOP, DCA I SETPNT
1277   01741  2347          ISZ SETPNT
1278   01742  1347          TAD SETPNT
1279   01743  1273          TAD BUFLIM
1280   01744  7640          SZA CLA
1281   01745  5340          JMP SETLOP
1282   01746  5726          JMP I SETBUF
1283
1284   01747  0000  SETPNT, 0
1285
```

```
1286
1287                    /
1288                    /       THIS HERE NOW THING CHECKS THE COORDINATES OF THE MOST RECENTLY
1289                    /       DISPLAYED PROJECTILE AGAINST THOSE OF THE SHIPS ON THE SCREEN.
1290                    /       IF WITH A COLLISION LIMIT  A HIT IS RECORDED AND THE LIFE
1291                    /       COUNT OF THE PROJECTILE ZEROED TO REMOVE IT.  A HIT SHIP
1292                    /       IS SUITABLY FLAGGED
1293                    /
1294
1295            2000            *2000
1296
1297    02000   0000    CHECK,  0                       /HERE TO TEST FOR A PROJECTILE HIT
1298    02001   1022            TAD ONEFLG              /CANT HIT SOMETHING IN HYPERSPACE
1299    02002   7640            SZA CLA
1300    02003   5232            JMP CHECK2
1301    02004   1020            TAD ONEOUT              /OR SOMETHING THAT'S BEEN HIT
1302    02005   7640            SZA CLA
1303    02006   5232            JMP CHECK2
1304
1305    02007   1110            TAD PROX                /CHECK X COORDINATES OF SHIP ONE
1306    02010   7041            CIA                     /AND PROJECTILE
1307    02011   1026            TAD ONEPEX              /THIS SORT OF THING IS WHY THE
1308    02012   7510            SPA                     /COORDINATES HAVE TO BE MAINTAINED TO 12
1309    02013   7041            CIA                     /BITS
1310    02014   1264            TAD LIMIT               /CLOSE ENOUGH?
1311    02015   7700            SMA CLA
1312    02016   5232            JMP CHECK2              /IF X ISN' CLOSE ENOUGH THEN NO HIT
1313    02017   1111            TAD PROY                /X WAS CLOSE ENOUGH, HOW ABOUT Y?
1314    02020   7041            CIA
1315    02021   1027            TAD ONEPEY
1316    02022   7510            SPA
1317    02023   7041            CIA
1318    02024   1264            TAD LIMIT
1319    02025   7700            SMA CLA
1320    02026   5232            JMP CHECK2              /NO HIT
1321
1322    02027   1107            TAD MEXP                /DEPOSIT EXPLOSION COUNT  IN ONEOUT
1323    02030   3020            DCA ONEOUT              /ALL THAT IS NECESSARY
1324    02031   4265            JMS CUTOUT              /REMOVE PROJECTILE
1325
```

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1326
1327
1328  02032  1035  CHECK2, TAD TWOFLG          /NO HIT ON NUMBER ONE, TRY NUMBER TWO
1329  02033  7640         SZA CLA
1330  02034  5600         JMP I CHECK          /BUT NOT IF IN HYPERSPACE
1331  02035  1033         TAD TWOOUT           /OR IF ALREADY HIT
1332  02036  7640         SZA CLA
1333  02037  5600         JMP I CHECK
1334
1335  02040  1110         TAD PROX             /CHECK X'S FIRST
1336  02041  7041         CIA
1337  02042  1041         TAD TWOPEX
1338  02043  7510         SPA                  /GET ABSOLUTE VALUE OF DIFFERENCE
1339  02044  7041         CIA
1340  02045  1264         TAD LIMIT            /AND TEST MAGNITUDE AGAINST PROXIMITY
1341  02046  7700         SMA CLA              /LIMIT
1342  02047  5600         JMP I CHECK          /NOWHERE NEAR CLOSE
1343
1344  02050  1111         TAD PROY             /NYAH, NYAH
1345  02051  7041         CIA                  /TRY THE Y'S
1346  02052  1042         TAD TWOPEY
1347  02053  7510         SPA
1348  02054  7041         CIA                  /ABSOLUTE VALUE OF DIFFERENCE
1349  02055  1264         TAD LIMIT
1350  02056  7700         SMA CLA
1351  02057  5600         JMP I CHECK          /CLEAN MISS!
1352
1353  02060  1107         TAD MEXP             /HIT ON TWO - END EVERYTHING BY SETTING
1354  02061  3033         DCA TWOOUT           /TWOOUT TO NON-ZERO EXPLOSION COUNT
1355  02062  4265         JMS CUTOUT
1356  02063  5600         JMP I CHECK          /EXIT AFTER DESTOYING PROJECTILE
1357
1358  02064  7660  LIMIT, -120                /PROXIMITY LIMIT FOR WHAT CONSTITUTES A HIT
1359
1360  02065  0000  CUTOUT, 0                  /THIS ROUTINE ZEROES OUT THE MOST RECENTLY
1361  02066  1132         TAD M4               /DISPLAYED PROJECTILE BY ZEROEING THE
1362  02067  1113         TAD BUFTMP           /COUNT
1363  02070  3273         DCA CUTPNT
1364  02071  3673         DCA I CUTPNT
1365  02072  5665         JMP I CUTOUT
1366
1367  02073  0000  CUTPNT, 0
1368
```

```
1369
1370                    /
1371                    /       THIS ROUTINE IS CALLED TO TEST FOR A COLLISION BETWEEN THE
1372                    /       TWO SHIPS.  THE COORDINATES OF BOTH ARE COMPARED
1373                    /       AND IFF SUFFICIENTLY CLOSE BOTH ARE DESTROYED BY SETTING
1374                    /       THEIR EXPLOSION COUNTS NON-ZERO.
1375                    /
1376
1377
1378    02074   0000    COLLID, 0                       /HERE TO TEST FOR COLLISION
1379    02075   1022            TAD ONEFLG              /NO TEST IF EITHER SHIP IS IN
1380    02076   7640            SZA CLA                 /HYPERSPACE OR EXPLODING
1381    02077   5674            JMP I COLLID
1382    02100   1035            TAD TWOFLG
1383    02101   7640            SZA CLA
1384    02102   5674            JMP I COLLID
1385    02103   1020            TAD ONEOUT
1386    02104   7640            SZA CLA
1387    02105   5674            JMP I COLLID
1388    02106   1033            TAD TWOOUT
1389    02107   7640            SZA CLA
1390    02110   5674            JMP I COLLID
1391
1392    02111   1026            TAD ONEPEX              /BOTH SHIPS AVAILABLE FOR COLLISION
1393    02112   7041            CIA                     /CHECK X COORDINATES FIRST
1394    02113   1041            TAD TWOPEX
1395    02114   7510            SPA                     /GET ABSOLUTE VALUE OF DIFFERENCE
1396    02115   7041            CIA
1397    02116   1336            TAD COLLIM              /CLOSE ENOUGH?
1398    02117   7700            SMA CLA
1399    02120   5674            JMP I COLLID            /NOPE, FORGET IT
1400
1401    02121   1027            TAD ONEPEY              /YES, NOW TRY THE Y COORDINATES
1402    02122   7041            CIA
1403    02123   1042            TAD TWOPEY
1404    02124   7510            SPA
1405    02125   7041            CIA                     /GET MAGNITUDE ONLY
1406    02126   1336            TAD COLLIM
1407    02127   7700            SMA CLA                 /CLOSE ENOUGH?
1408    02130   5674            JMP I COLLID
1409    02131   1107            TAD MEXP                /YES, SET BOTH EXPLOSION COUNTS
1410    02132   3020            DCA ONEOUT
1411    02133   1107            TAD MEXP
1412    02134   3033            DCA TWOOUT
1413    02135   5674            JMP I COLLID
1414
1415    02136   7500    COLLIM, -300
```

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1416
1417                    /
1418                    /       THIS ROUTINE IS CALLED TO SET ONE OF THE TWO SHIPS INTO
1419                    /       HYPERSPACE.  ON ENTRY THE AC=-1 FOR SHIP #1, 0 FOR SHIP
1420                    /       NUMBER 2.  THE LOCATION CLOCK IS USED FOR A RANDOM
1421                    /       ADDRESS POINTER FROM WHICH WILL BE DRAWN THE
1422                    /       VARIOUS PARAMETERS FOR REENTRY.
1423                    /
1424
1425            2200            *2200
1426
1427    02200   3253    HYPSET, DCA RTNFLG              /HERE WITH AC=-1 OR 0
1428    02201   1253            TAD RTNFLG              /SET UP LIST POINTER
1429    02202   7640            SZA CLA
1430    02203   1251            TAD ONEDIF              /TO APPROPRIATE SHIP FILE
1431    02204   1252            TAD TWOLST
1432    02205   3015            DCA AUTO15
1433
1434    02206   1075            TAD CLOCK               /SET UP "RANDOM NUMBER GENERATOR"
1435    02207   3017            DCA AUTO17
1436    02210   1417            TAD I AUTO17            /PICK UP FIRST THE AMOUNT OF TIME
1437    02211   0250            AND TIMOUT              /OUT OF NOMAL SPACE LIMITED TO =777
1438    02212   7041            CIA                     /UPDATE CYCLES ( ABOUT 15 SECONDS)
1439    02213   3415            DCA I AUTO15            /AND STORE IN ONEOUT OR TWO OUT
1440
1441    02214   1417            TAD I AUTO17            /THE NEXT RANDOM NUMBER BECOMES THE
1442    02215   4500            JMS I THEADJ            /ANGLE OR ORIENTATION ON REENTRY
1443    02216   3415            DCA I AUTO15
1444    02217   1417            TAD I AUTO17            /AND THE NEXT BECOMES THE X VELOCITY
1445    02220   4260            JMS VEESET              /COMPONENT
1446    02221   3415            DCA I AUTO15
1447    02222   1417            TAD I AUTO17            /AND THEN THE Y COMPONENT
1448    02223   4260            JMS VEESET
1449    02224   3415            DCA I AUTO15
1450    02225   1417            TAD I AUTO17
1451    02226   3415            DCA I AUTO15
1452
1453    02227   1417            TAD I AUTO17
1454    02230   3415            DCA I AUTO15
1455
1456    02231   1417            TAD I AUTO17            /FINALLY SEE IF RETURN WILL BE SUCCESSFLY
1457    02232   0250            AND TIMOUT
1458    02233   1257            TAD MHYP                /ABOUT 3/4 CHANCE
1459    02234   7700            SMA CLA
1460    02235   5245            JMP HYPRET              /OK
1461    02236   1253            TAD RTNFLG              /THIS IS THE ONE TIME IN FOUR,  SET
1462    02237   7640            SZA CLA                 /UP FOR EXPLOSION ON REENTRY
1463    02240   1251            TAD ONEDIF
1464    02241   1256            TAD OUTLOC
1465    02242   3260            DCA VEESET
1466    02243   1107            TAD MEXP
1467    02244   3660            DCA I VEESET
1468
1469    02245   2253    HYPRET, ISZ RTNFLG
1470    02246   5655            JMP I TWORTN
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1471   02247  5654          JMP I ONERTN
1472
1473   02250  0777  TIMOUT, 777
1474   02251  7765  ONEDIF, ONEFLG-TWOFLG
1475   02252  0034  TWOLST, TWOFLG-1
1476   02253  0000  RTNFLG, 0
1477   02254  0600  ONERTN, TWOUP
1478   02255  1000  TWORTN, ONESET
1479   02256  0033  OUTLOC, TWOOUT
1480   02257  7600  MMYP,   -200
1481
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1482
1483
1484  02260  0000  VEESET, 0                    /HERE TO LIMIT VELOCITY COMPONENTS
1485  02261  7100        CLL
1486  02262  7510        SPA                    /GET MAGNITUDE
1487  02263  7020        CML
1488  02264  0270        AND HM177              /LIMIT TO 177
1489  02265  7530        SZL CLL
1490  02266  7041        CIA
1491  02267  5660        JMP I VEESET           /AND EXIT
1492
1493  02270  0177  HM177, 177
1494
1495  02271  7300  ONEEXP, CLA CLL             /HERE TO DISPLAY SHIP NUMBER ONE AS
1496  02272  1023        TAD ONETHE             /AN EXPLOSION
1497  02273  1333        TAD INCONE             /FIRST ROTATE IT BY A GOOD DOLLOP
1498  02274  3023        DCA ONETHE
1499  02275  4732        JMS I IXPDIS           /THEN CALL THE EXPLOSION GENERATOR
1500  02276  2020        ISZ ONEOUT             /DONE WITH THE EXPLOSION?
1501  02277  5727        JMP I NOWTWO           /NO, NORMAL RETURN
1502
1503  02300  7001        IAC                    /YES, SET INTO PSEUDO HYPER SPACE
1504  02301  3022        DCA ONEFLG
1505  02302  7001        IAC                    /DISABLE RETURN FROM HYPER SPACE
1506  02303  3032        DCA ONEFI
1507
1508  02304  1045        TAD TWOFIN             /IS NUMBER TWO STILL AROUND?
1509  02305  7650        SNA CLA
1510  02306  5727        JMP I NOWTWO           /YES, RETURN
1511  02307  5731        JMP I TIEUP            /NO, TIE BALL GAME
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```
1512
1513
1514  02310  7300  TWOEXP, CLA CLL                 /HERE TO DISPLAY SHIP NUMBER TWO
1515  02311  1036          TAD TWOTHE              /AS AN EXPLOSION,  BASH IT AROUND
1516  02312  1334          TAD INCTWO
1517  02313  3036          DCA TWOTHE
1518  02314  4732          JMS I IXPDIS            /THEN DISPLAY IT
1519  02315  2033          ISZ TWOOUT              /DONE WITH EXPLOSION?
1520  02316  5730          JMP I NOWPRO            /NO, NORMAL RETURN
1521
1522  02317  7001          IAC                     /YES, SEND INTO PSEUDO HYPER SPACE
1523  02320  3035          DCA TWOFLG
1524  02321  7001          IAC                     /DISABLE NORMAL RETURN FROM HYPERSPACE
1525  02322  3045          DCA TWOFIN
1526                                               /CHECK NUMBER ONE
1527  02323  1032          TAD ONEFIN
1528  02324  7640          SZA CLA                 /STILL ALIVE AND WELL?
1529  02325  5731          JMP I TIEUP             /NO, TIE GAME
1530  02326  5730          JMP I NOWPRO            /YES, CONTINUE ON
1531  02327  1436  NOWTWO, TWODIS
1532  02330  1600  NOWPRO, PRODIS
1533  02331  2523  TIEUP,  NOWIN
1534  02332  2400  IXPDIS, EXPDIS
1535  02333  0055  INCONE, 55
1536  02334  0055  INCTWO, 55
1537
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1538
1539                    /
1540                    /       HERE TO DISPLAY THE FIGURE POINTED TO BY AUTO10 AS
1541                    /       AN EXPLOSION,  THIS WORKS THE SAME WAY AS THE NORMAL
1542                    /       DISPLAY ROUTINE EXCEPT THAT THE COORDINATE INCREMENTS
1543                    /       ARE INVERTED TURNING THE FIGURE INSIDE OUT FOR S
1544                    /       A SORT OF CLOBBY EXPLOSION.
1545                    /
1546
1547            2400            *2400
1548
1549    02400   0000    EXPDIS, 0                       /HERE TO DISPLAY A FIGURE INSIDE OUT
1550    02401   1410            TAD I AUTO10            /WITH THE POINTERS AND COUNTS ALREADY
1551    02402   3050            DCA XTWODS              /SET UP BY FILDIS OR TWODIS
1552    02403   1410            TAD I AUTO10            /STICK NEXT TWO POINTS INTO LINE
1553    02404   3051            DCA YTWODS
1554
1555    02405   1050            TAD XTWODS
1556    02406   7041            CIA                     /CALCULATE INCREMENT THE WRONG WAY
1557    02407   1046            TAD XONEDS
1558    02410   3052            DCA DIXTEM              /AND STORE
1559    02411   1051            TAD YTWODS
1560    02412   7041            CIA
1561    02413   1047            TAD YONEDS
1562    02414   3053            DCA DIYTEM              /SAME FOR Y
1563
1564    02415   1132            TAD M4                  /4 DOTS IN THE VECTOR"
1565    02416   3054            DCA DISCNT              /COULD HAVE CALLED THE OTHER
1566                            /VECTOR GENERATOR I SUPPOSE
1567    02417   1046    EXPLOP, TAD XONEDS
1568    02420   1052            TAD DIXTEM              /ADD X AND Y INCREMENTS TO THE RUNNING
1569    02421   3046            DCA XONEDS              /TOTALS AND DISPLAY THE RUNNING
1570    02422   1047            TAD YONEDS              /TOTALS NORMAL SIZE
1571    02423   1053            TAD DIYTEM
1572    02424   3047            DCA YONEDS
1573
1574    02425   1046            TAD XONEDS
1575    02426   7012            RTR                     /COULD MAKE TWICE AS BIG BY NOP-ING
1576    02427   7010            RAR                     /THE RAR'S BUT THE SCREEN IS SMALL ENOUGH
1577    02430   6303            DXC DXL                 /AS IT IS
1578    02431   7200            CLA
1579    02432   1047            TAD YONEDS
1580    02433   7012            RTR
1581    02434   7010            RAR
1582    02435   6317            DYC DYL DIS
1583    02436   7200            CLA
1584    02437   2054            ISZ DISCNT              /DONE 4 DOTS?
1585    02440   5217            JMP EXPLOP              /NO
1586
1587    02441   2011            ISZ AUTO11              /DONE ALL VECTORS IN THE FILE?
1588    02442   7410            SKP
1589    02443   5600            JMP I EXPDIS            /YES, EXIT
1590
1591    02444   1050            TAD XTWODS              /NO SWAP TO NEXT PAIR OF POINTS
1592    02445   3046            DCA XONEDS
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1593   02446  1051          TAD YTWODS
1594   02447  3047          DCA YONEDS
1595   02450  5201          JMP EXPDIS+1
1596
1597
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```
1598
1599                    /
1600                    /       VEELIM IS THE SCALING ROUTINE FOR VELOCITY COMPONENTS.
1601                    /       THE COMPONENTS ARE SCALED TO REMAIN IN THE RANGE 140
1602                    /       TO -140.  THIS IS NECESSARY TO AVOID ASTRONOMICAL SPPED
1603                    /       BUILDUP ON THE SMALL SCREEN.  UNFORTUNATELY THE X AND Y
1604                    /       COMPONENTS ARE SCALED SEPARATELY WHICH GIVES SLIGHT BUT
1605                    /       NOTICABLE DISTORTIONS IN DIAGONAL FLIGHT PATHS.  IN THE
1606                    /       NORMAL HEAT OF THE BATTLE NO ONE WILL REALLY NOTICE.
1607                    /
1608
1609
1610    02451   0000    VEELIM, 0                       /ENTER TO SCALE VELOCITY HELD IN
1611    02452   3272            DCA VEEHLD              /AC
1612    02453   1272            TAD VEEHLD
1613    02454   7500            SMA                     /BRANCH FOR POSITIVE OR NEGATIV
1614    02455   5263            JMP VEEPOS
1615    02456   1274            TAD VEEMAX
1616    02457   7700            SMA CLA                 /GREATER THAN MAXIMUM POSITIVE?
1617    02460   5270            JMP VEECLR              /NO
1618    02461   1273            TAD VEEMIN              /I MEAN MAXIMUM NEGATIVE - YES SET
1619    02462   5651            JMP I VEELIM            /TO MAX NEGATIV
1620
1621    02463   1273    VEEPOS, TAD VEEMIN              /GREATER THAN MAX?
1622    02464   7710            SPA CLA
1623    02465   5270            JMP VEECLR              /NO
1624    02466   1274            TAD VEEMAX              /YES SET TO MAX
1625    02467   5651            JMP I VEELIM
1626
1627    02470   1272    VEECLR, TAD VEEHLD              /IT WAS IN RANGE ALL ALONG
1628    02471   5651            JMP I VEELIM
1629
1630    02472   0000    VEEHLD, 0
1631    02473   7640    VEEMIN, -140
1632    02474   0140    VEEMAX, 140
1633
1634    02475   0000    THEAJI, 0                       /HERE TO ADJUST THE ANGLE TO A RANGE
1635    02476   7500            SMA                     /0-550 OR 0-360 DEGREES.  THIS IS
1636    02477   5302            JMP .+3                 /NECESSARY TO INSURE THAT PUSHDOWN OVERFLOW
1637    02500   1130            TAD P550                /WILL NOT HAPPEN IN THE SINE AND COSINE
1638    02501   5276            JMP .-3                 /ROUTINES.  THIS SIMPLY TAKES THE AC
1639    02502   1141            TAD M550                /MODULO 360 AND EXITS
1640    02503   7500            SMA
1641    02504   5302            JMP .-2
1642    02505   1130            TAD P550                /FOLLOW IT THROUGH AND SEE IF IT DOESN'T
1643    02506   5675            JMP I THEAJI
1644
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1645
1646                    /
1647                    /       ONE OF THESE ROUTINE IS ENTERED WHEN A WINNER IS DECLARED.
1648                    /       THE ADDRESS OF THE VICTORY MESSAGE IS PLACED IN MESS AND
1649                    /       THE GAMOVR FLAG SET TO CAUSE A BRANCH TO JOBLOP WHEN THE
1650                    /       DISPLAY CYCLE IS COMPLETED.  THE ROUTINE WILL THEN DISPLAY
1651                    /       THE APPROPRIATE MESSAGE OVER THE REMAINING SHIPS IF
1652                    /       ANY UNTIL THE KEYBOARD IS MOLESTED OR THE CLOCK RUNS OUT
1653                    /       AND THE NEXT DISPLAY UPDATE CYCLE IS SET.   AT ANY RATE THE
1654                    /       PROGRAM WILL REACH HERE ONLY WHEN SOMEONE HAS BITTEN THE
1655                    /       INTERGALACTIC DUST.
1656                    /
1657
1658
1659    02507   0000    ONEWIN, 0                       /THIS IS CALLED WHEN TWOFIN IS SET
1660    02510   1342            TAD MES1                /AND ONE FIN IS NOT.  SET ONE TO VICTOR
1661    02511   3347            DCA MESS                /AND SET GAMOVR FLAG
1662    02512   7001            IAC
1663    02513   3104            DCA GAMOVR
1664    02514   5707            JMP I ONEWIN            /THEN RETURN TO UPDATE CYCLE
1665
1666    02515   0000    TWOWIN, 0                       /THIS IS CALLED WHEN ONEFIN IS SET
1667    02516   1343            TAD MES2                /AND TWO FIN IS NOT
1668    02517   3347            DCA MESS                /SET ALSO GAMOVR
1669    02520   7001            IAC
1670    02521   3104            DCA GAMOVR
1671    02522   5715            JMP I TWOWIN
1672
1673    02523   1345    NOWIN,  TAD MES4                /GET HERE WHEN BOTH ONEFIN AND TWOFIN
1674    02524   3347            DCA MESS                /ARE SET .
1675    02525   7001            IAC
1676    02526   3104            DCA GAMOVR              /NOBODY EVER REALLY WINDS
1677                                                    /UP THE WINNER IN THESE THINGS
1678    02527   6325    JOBLOP, DSB 1                   /THIS IS ENTERED FROM FINISH WHEN
1679    02530   1341            TAD MES0                /GAMOVR IS SET AND SERVES TO DISPLAY
1680    02531   4477            JMS I MESOUT            /THE VICTORY MESSAGE ON THE SCREEN
1681    02532   1347            TAD MESS                /USING THE CHARACTER GENERATOR SOMEWHAT
1682    02533   4477            JMS I MESOUT            /FURTHER ON UNTIL THE GAME IS RESTARTED
1683    02534   1346            TAD MES5                /OR UNTIL THE INTERRUPT COUNT OVERFLOWS
1684    02535   4477            JMS I MESOUT            /AND THE UPDATE CYCLE IS RESTARTED
1685    02536   1344            TAD MES3
1686    02537   4477            JMS I MESOUT
1687    02540   5327    FINITO, JMP JOBLOP
1688
1689    02541   7337    MES0,   MESS0
1690    02542   7344    MES1,   MESS1
1691    02543   7346    MES2,   MESS2
1692    02544   7350    MES3,   MESS3
1693    02545   7353    MES4,   MESS4
1694    02546   7340    MES5,   MESS5
1695    02547   0000    MESS,   0
1696
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1697
1698                    /
1699                    /       THE FOLLOWING ARE THE SINE AND COSINE ROUTINES CUSTOMIZED
1700                    /       FOR THIS PROGRAM FROM ANOTHER I WORKED ON,  CALL EITHER
1701                    /       SINE OR COSINE WITH ANGLE IN DEGREES IN AC,  THE ARGUEMENT
1702                    /       IS REDUCED THROUGH RECURSION UNTIL BETWEEN 0-89 DEGREES
1703                    /       AND THEN A TABLE LOOKUP DONE TO OBTAIN THE VALUE.  IT TAKES
1704                    /       UP A FAIR AMOUNT OF SPACE BUT IT WORKS JUST FASTER
1705                    /       THAN SHEEP.  THE COSINE CALL JUST TRANSFORMS THE ARGUEMENT
1706                    /       THROUGH SOME TRIGONOMETRIC GARBAGE AND CALLS THE SINE
1707                    /       ROUTINE.  NOTE THAT CALLING EITHER ROUTINE WITH TOO
1708                    /       LARGE AN ARGUEMENT WILL CAUSE PUSHDOWN OVERFLOW AND THEN
1709                    /       ALL HELL WILL BREAK LOOSE.  THE ORIGINAL ROUTINE FROM WHICH
1710                    /       THIS WAS STOLEN HAD FULL WORD PRECISION.
1711                    /
1712
1713            6400            *6400
1714
1715    06400   0000    SINEIN, 0                       /I REALLY CANT BRING MYSELF TO COMMENT
1716    06401   3252            DCA SINARG              /THIS.  IT'S VERY STRAIGHFORWARD
1717    06402   1200            TAD SINEIN
1718    06403   3653            DCA I SINPSH
1719    06404   2253            ISZ SINPSH
1720    06405   1252            TAD SINARG
1721    06406   7440            SZA
1722    06407   5217            JMP SINNG2
1723
1724    06410   7340    SINPOP, CLA CLL CMA
1725    06411   1253            TAD SINPSH
1726    06412   3253            DCA SINPSH
1727    06413   1653            TAD I SINPSH
1728    06414   3200            DCA SINEIN
1729    06415   1252            TAD SINARG
1730    06416   5600            JMP I SINEIN
1731
1732    06417   7500    SINNG2, SMA
1733    06420   5226            JMP SINPOS
1734    06421   7041            CIA
1735    06422   4200            JMS SINEIN
1736
1737    06423   7041    SINNEG, CIA
1738    06424   3252            DCA SINARG
1739    06425   5210            JMP SINPOP
1740
1741    06426   1136    SINPOS, TAD M264
1742    06427   7510            SPA
1743    06430   5232            JMP .+2
1744    06431   5222            JMP SINNEG-1
1745    06432   1125            TAD P132
1746    06433   7510            SPA
1747    06434   5244            JMP SINELK
1748    06435   7640            SZA CLA
1749    06436   5241            JMP .+3
1750    06437   1122            TAD P37
1751    06440   5224            JMP SINNEG+1
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1752
1753  06441  1252          TAD SINARG
1754  06442  1136          TAD M264
1755  06443  5222          JMP SINNEG-1
1756
1757  06444  1125  SINELK, TAD P132
1758  06445  1262          TAD SINTAB
1759  06446  3200          DCA SINEIN
1760  06447  1600          TAD I SINEIN
1761  06450  3252          DCA SINARG
1762  06451  5210          JMP SINPOP
1763
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1764
1765
1766   06452  0000  SINARG, 0
1767   06453  6454  SINPSH, SINLST
1768   06454  0000  SINLST, 0
1769   06455  0000          0
1770   06456  0000          0
1771   06457  0000          0
1772   06460  0000          0
1773   06461  0000          0
1774
1775   06462  6467  SINTAB, SINES-1
1776
1777   06463  0000  COSINI, 0
1778   06464  7041          CIA
1779   06465  1125          TAD P132
1780   06466  4200          JMS SINEIN
1781   06467  5663          JMP I COSINI
1782
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1783
1784
1785   06470  0000  SINES,  00      /1
1786   06471  0001          01      /2
1787   06472  0001          01      /3
1788   06473  0002          02      /4
1789   06474  0002          02      /5
1790   06475  0003          03      /6
1791   06476  0003          03      /7
1792   06477  0004          04      /8
1793   06500  0005          05      /9
1794   06501  0005          05      /10
1795   06502  0006          06      /11
1796   06503  0006          06      /12
1797   06504  0007          07      /13
1798   06505  0007          07      /14
1799   06506  0010          10      /15
1800   06507  0010          10      /16
1801   06510  0011          11      /17
1802   06511  0011          11      /18
1803   06512  0012          12      /19
1804   06513  0012          12      /20
1805   06514  0013          13      /21
1806   06515  0013          13      /22
1807   06516  0014          14      /23
1808   06517  0015          15      /24
1809   06520  0015          15      /25
1810   06521  0016          16      /26
1811   06522  0016          16      /27
1812   06523  0017          17      /28
1813   06524  0017          17      /29
1814   06525  0020          20      /30
1815   06526  0020          20      /31
1816   06527  0020          20      /32
1817   06530  0021          21      /33
1818   06531  0021          21      /34
1819   06532  0022          22      /35
1820   06533  0022          22      /36
1821   06534  0023          23      /37
1822   06535  0023          23      /38
1823   06536  0024          24      /39
1824   06537  0024          24      /40
1825   06540  0025          25      /41
1826   06541  0025          25      /42
1827   06542  0025          25      /43
1828   06543  0026          26      /44
1829   06544  0026          26      /45
1830   06545  0027          27      /46
1831   06546  0027          27      /47
1832   06547  0027          27      /48
1833   06550  0030          30      /49
1834   06551  0030          30      /50
1835   06552  0030          30      /51
1836   06553  0031          31      /52
1837   06554  0031          31      /53
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1838   06555  0031          31      /54
1839   06556  0032          32      /55
1840   06557  0032          32      /56
1841   06560  0032          32      /57
1842   06561  0033          33      /58
1843   06562  0033          33      /59
1844   06563  0033          33      /60
1845   06564  0033          33      /61
1846   06565  0034          34      /62
1847   06566  0034          34      /63
1848   06567  0034          34      /64
1849   06570  0035          35      /65
1850   06571  0035          35      /66
1851   06572  0035          35      /67
1852   06573  0035          35      /68
1853   06574  0035          35      /69
1854   06575  0036          36      /70
1855   06576  0036          36      /71
1856   06577  0036          36      /72
1857   06600  0036          36      /73
1858   06601  0036          36      /74
1859   06602  0036          36      /75
1860   06603  0037          37      /76
1861   06604  0037          37      /77
1862   06605  0037          37      /78
1863   06606  0037          37      /79
1864   06607  0037          37      /80
1865   06610  0037          37      /81
1866   06611  0037          37      /82
1867   06612  0037          37      /83
1868   06613  0037          37      /84
1869   06614  0037          37      /85
1870   06615  0037          37      /86
1871   06616  0037          37      /87
1872   06617  0037          37      /88
1873   06620  0037          37      /89
1874
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1875
1876
1877  06621  0000  MULTI,  0                    /THIS IS STANDARD SINGLE PRECISION
1878  06622  7100          CLL                  /MULTIPLY ROUTINE WHICH WAS ONCE
1879  06623  7510          SPA                  /USED.  I'VE LEFT IT IN SINCE
1880  06624  7061          CMA CML IAC          /THERE IS LOTS OF CORE LEFT OVER AND
1881  06625  3271          DCA MULMP1           /MAYBLE SOMEDAY I'LL NEED IT TO PUT
1882  06626  3272          DCA MULMP5           /IN A SUN OR SOMETHING.  THIS IS THE
1883  06627  1621          TAD I MULTI          /STANDARD DEC SUBROUTINE WITH DIFFERENT
1884  06630  7450          SNA                  /LABELS
1885  06631  5255          JMP MULPSN+2
1886  06632  7510          SPA
1887  06633  7061          CMA CML IAC
1888  06634  3273          DCA MULMP2
1889  06635  1270          TAD MULTHR
1890  06636  3274          DCA MULMP3
1891
1892  06637  1271  MULMP4, TAD MULMP1
1893  06640  7010          RAR
1894  06641  3271          DCA MULMP1
1895  06642  1272          TAD MULMP5
1896  06643  7430          SZL
1897  06644  1273          TAD MULMP2
1898  06645  7110          CLL RAR
1899  06646  3272          DCA MULMP5
1900  06647  2274          ISZ MULMP3
1901  06650  5237          JMP MULMP4
1902  06651  1271          TAD MULMP1
1903  06652  7010          RAR
1904  06653  7430  MULPSN, SZL
1905  06654  5261          JMP MULCMP
1906  06655  3271          DCA MULMP1
1907  06656  1272          TAD MULMP5
1908  06657  2221  MULMPZ, ISZ MULTI
1909  06660  5621          JMP I MULTI
1910
1911  06661  7141  MULCMP, CMA CLL IAC
1912  06662  3271          DCA MULMP1
1913  06663  1272          TAD MULMP5
1914  06664  7040          CMA
1915  06665  7430          SZL
1916  06666  7001          IAC
1917  06667  5257          JMP MULMPZ
1918
1919  06670  7764  MULTHR, 7764
1920  06671  0000  MULMP1, 0
1921  06672  0000  MULMP5, 0
1922  06673  0000  MULMP2, 0
1923  06674  0000  MULMP3, 0
1924
```

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1925
1926                    /
1927                    /       SHIFTR DIVIDES THE AC BY TWO WHETHER POSITIVE OR NEGATIVE
1928                    /       AND IS CALLED FROM VARIOUS PLACES.   NOT ENTIRELY MYSTERIOUS
1929                    /
1930
1931
1932    06675   0000    SHIFTR, 0
1933    06676   7100            CLL
1934    06677   7510            SPA
1935    06700   7021            CML IAC
1936    06701   7010            RAR
1937    06702   5675            JMP I SHIFTR
1938
1939
1940                    /
1941                    /       POSCAL IS CALLED TO CALCULATE THE COORDINATE INCREMENTS
1942                    /       NECESSARY TO PRODUCE THE SHIP FIGURES.  RATHER THAN DOING
1943                    /       A LOT OF EXPENSIVE MATH THIS DOES A QUICK PRODUCTION
1944                    /       OF 1, 2, AND 3 TIMES THE SIN AND COSINE VALUES FOUND
1945                    /       IN CALSIN AND CALCOS LEAVING THEM IN THE TABLE FOR
1946                    /       ONESET AND TWOSET.  IF THE SCOPE WERE ANY BETTER
1947                    /       THIS PROBABLY WOULDN'T BE NEAR GOOD ENOUGH BUT....
1948                    /
1949
1950    06703   0000    POSCAL, 0
1951    06704   1063            TAD CALSIN
1952
1953    06705   3055            DCA T10SIN
1954    06706   1055            TAD T10SIN
1955    06707   7104            CLL RAL
1956    06710   3056            DCA T20SIN
1957    06711   1055            TAD T10SIN
1958    06712   1056            TAD T20SIN
1959    06713   3057            DCA T30SIN
1960
1961    06714   1064            TAD CALCOS
1962
1963    06715   3060            DCA T10COS
1964    06716   1060            TAD T10COS
1965    06717   7104            CLL RAL
1966    06720   3061            DCA T20COS
1967    06721   1060            TAD T10COS
1968    06722   1061            TAD T20COS
1969    06723   3062            DCA T30COS
1970    06724   5703            JMP I POSCAL
1971
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1972
1973            7000            *7000
1974
1975                    /GENERAL PURPOSE SYMBOL GENERATOR
1976                    /
1977    07000   0000    CHARS,  0       /ENTRY TO PLOT CHARACTER STRING
1978    07001   3330            DCA ADDR        /STORE STRING ADDRESS
1979    07002   1730            TAD I ADDR      /FETCH DOUBLE CHARACTER
1980    07003   7012            RTR     /SHIFT
1981    07004   7012            RTR     /       FOR FIRST
1982    07005   7012            RTR     /       CHARACTER
1983    07006   4216            JMS CHAR        /PLOT CHARACTER
1984    07007   7410            SKP     /NORMAL RETURN -- SKIP
1985    07010   5600            JMP I CHARS     /TERMINATION RETURN -- EXIT
1986    07011   1730            TAD I ADDR      /RECALL DOUBLE CHARACTER
1987    07012   2330            ISZ ADDR        /ADVANCE STRING ADDRESS
1988    07013   4216            JMS CHAR        /PLOT CHARACTER
1989    07014   5202            JMP CHARS+2     /NORMAL RETURN -- REPEAT
1990    07015   5600            JMP I CHARS     /TERMINATION RETURN -- EXIT
1991                    /
1992    07016   0000    CHAR,   0       /ENTRY TO PLOT SINGLE CHARACTER
1993    07017   0334            AND K77 /MASK OUT UPPER BITS
1994    07020   7104            CLL RAL /MULTIPLY CODE BY TWO
1995    07021   1336            TAD TABLE       /ADD TABLE BASE ADDRESS
1996    07022   3335            DCA POINT       /CONSTRUCT POINTER TO 24-BIT CODE
1997    07023   7040            CMA     /INITIALIZE COUNTER FOR
1998    07024   3332            DCA COUNT2      /       TWO PLOT WORDS
1999    07025   1735            TAD I POINT     /FETCH FIRST PLOT WORD
2000    07026   2335            ISZ POINT       /INCREMENT POINTER FOR NEXT ONE
2001    07027   7450            SNA     /SKIP IF NOT SPECIAL CHARACTER
2002    07030   5274            JMP SPCHAR      /ELSE GO PROCESS IT
2003    07031   3327            DCA CURPLT      /SAVE CURRENT PLOT BITS
2004    07032   1333    XPLOT,  TAD K6 /INITIALIZE 6-BIT
2005    07033   3331            DCA COUNT6      /       COUNTER
2006    07034   1323            TAD YVALUE      /RESET Y TEMPORARY
2007    07035   3326            DCA YTEMP       /       VALUE FOR CHARACTER
2008    07036   1322            TAD XVALUE      /OUTPUT CURRENT
2009    07037   6303            DXC DXL /       X-VALUE TO CRT
2010    07040   1324            TAD XINCR       /INCREMENT
2011    07041   3322            DCA XVALUE      /       ABSCISSA
2012    07042   1327    YPLOT,  TAD CURPLT      /RECALL CURRENT PLOT BITS
2013    07043   7104            CLL RAL /GET NEXT BIT
2014    07044   3327            DCA CURPLT      /SAVE REMAINING PLOT BITS
2015    07045   7420            SNL     /SKIP IF POINT TO PLOT
2016    07046   5255            JMP CNTINU      /ELSE JUMP AHEAD
2017    07047   1326            TAD YTEMP       /OUTPUT CURRENT
2018    07050   6317            DYC DYL DIS     /       Y-VALUE TO CRT
2019    07051   7300            CLA CLL /CLEAR AC
2020    07052   1327            TAD CURPLT      /RECALL CURRENT PLOT BITS
2021    07053   7650            SNA CLA /SKIP IF POINTS REMAINING
2022    07054   5263            JMP WRDEND      /ELSE WORD IS FINISHED
2023    07055   1326    CNTINU, TAD YTEMP       /INCREMENT TEMPORARY
2024    07056   1325            TAD YINCR       /       Y-VALUE FOR NEXT
2025    07057   3326            DCA YTEMP       /       CHARACTER STEP
2026    07060   2331            ISZ COUNT6      /SKIP IF 6 BITS PLOTTED
```

```
2027   07061  5242          JMP YPLOT       /ELSE PLOT NEXT ONE
2028   07062  5232          JMP XPLOT       /GO UPDATE X-VALUE
2029   07063  2332  WRDEND, ISZ COUNT2      /SKIP IF ANOTHER BIT WORD
```

```
2030  07064  5270          JMP EXIT        /ELSE EXIT
2031  07065  1735          TAD I POINT     /FETCH SECOND BIT WORD
2032  07066  7440          SZA     /SKIP IF NO PLOT POINTS
2033  07067  5231          JMP XPLOT-1     /ELSE GO PLOT THEM
2034  07070  1322  EXIT,   TAD XVALUE      /INCREMENT ABSCISSA
2035  07071  1324          TAD XINCR       /       FOR SPACE BETWEEN
2036  07072  3322          DCA XVALUE      /       SYMBOLS
2037  07073  5616          JMP I CHAR      /EXIT FROM CHAR
2038                /
2039  07074  1735  SPCHAR, TAD I POINT     /FETCH TRANSFER VECTOR
2040  07075  3335          DCA POINT       /STORE AS INDIRECT ADDRESS
```

```
2041  07076  5735          JMP I POINT     /GO TO APPROPRIATE ROUTINE
2042  07077  1324  SPACE,  TAD XINCR       /FETCH BASIC ABSCISSA INCREMENT
2043  07100  7106          CLL RTL /MULTIPLY BY FOUR AND
2044  07101  5270          JMP EXIT        /       GO CREATE SPACE
2045  07102  1320  CRLF,   TAD INITX       /"CARRIAGE RETURN" RESETS X
2046  07103  3322          DCA XVALUE      /       TO ITS ORIGINAL VALUE
2047  07104  1325  LF,     TAD YINCR       /"LINE FEED"
2048  07105  7106          CLL RTL /       DECREMENTS THE
2049  07106  7145          CLL CIA RAL     /       Y-VALUE BY
2050  07107  1323          TAD YVALUE      /       EIGHT SCALE
2051  07110  3323          DCA YVALUE      /       STEPS
2052  07111  5616          JMP I CHAR      /EXIT FROM CHAR
2053  07112  1320  RESET,  TAD INITX       /"RESET" RESETS
2054  07113  3322          DCA XVALUE      /       X AND Y TO
2055  07114  1321          TAD INITY       /       THEIR ORIGINAL
2056  07115  5310          JMP RESET-2     /       VALUES
2057  07116  2216  TERM,   ISZ CHAR        /TERMINATE CODE CAUSES
2058  07117  5616          JMP I CHAR      /       EXIT TO P+2
2059                       /
2060  07120  0000  INITX,  0       /INITIAL X-VALUE
2061  07121  0327  INITY,  327     /INITIAL Y-VALUE
2062  07122  0000  XVALUE, 0       /CURRENT X-VALUE
2063  07123  0000  YVALUE, 0       /CURRENT Y-VALUE
2064  07124  0006  XINCR,  6       /BASIC X INCREMENT VALUE
2065  07125  0010  YINCR,  10      /BASIC Y INCREMENT VALUE
2066  07126  0000  YTEMP,  0       /TEMPORARY Y-VALUE
2067  07127  0000  CURPLT, 0       /CURRENT PLOT BITS
2068  07130  0000  ADDR,   0       /CURRENT STRING ADDRESS
2069  07131  0000  COUNT6, 0       /6-BIT COUNTER
2070  07132  0000  COUNT2, 0       /2-WORD COUNTER
2071  07133  7772  KM6,    -6      /CONSTANT FOR COUNT6
2072  07134  0077  K77,    77      /CHARACTER CODE MASK
2073  07135  0000  POINT,  0       /TABLE POINTER
2074                       /
```

```
2075
2076                                /
2077   07136  7137   TABLE,  .+1      /TABLE BASE ADDRESS
2078   07137  0000           0        /SPECIAL CHARACTER (00)
2079   07140  7116           TERM     /TERMINATION CODE
2080   07141  7611           7611     / A
2081   07142  1176           1176
2082   07143  7745           7745     / B
2083   07144  4532           4532
2084   07145  3641           3641     / C
2085   07146  4122           4122
2086   07147  7741           7741     / D
2087   07150  4136           4136
2088   07151  7745           7745     / E
2089   07152  4541           4541
2090   07153  7705           7705     / F
2091   07154  0501           501
2092   07155  7741           7741     / G
2093   07156  5173           5173
2094   07157  7710           7710     / H
2095   07160  1077           1077
2096   07161  4177           4177     / I
2097   07162  4100           4100
2098   07163  2040           2040     / J
2099   07164  4037           4037
2100   07165  7714           7714     / K
2101   07166  2241           2241
2102   07167  7740           7740     / L
2103   07170  4040           4040
2104   07171  7702           7702     / M
2105   07172  0277           277
2106   07173  7706           7706     / N
2107   07174  3077           3077
2108   07175  7741           7741     / O
2109   07176  4177           4177
2110   07177  7705           7705     / P
2111   07200  0502           502
2112   07201  3641           3641     / Q
2113   07202  6176           6176
2114   07203  7715           7715     / R
2115   07204  2542           2542
2116   07205  2245           2245     / S
2117   07206  5122           5122
2118   07207  0177           177      / T
2119   07210  0100           100
2120   07211  3740           3740     / U
2121   07212  4037           4037
2122   07213  1720           1720     / V
2123   07214  4037           4037
2124   07215  7730           7730     / W
2125   07216  3077           3077
2126   07217  4136           4136     / X
2127   07220  3641           3641
2128   07221  0374           374      / Y
2129   07222  7403           7403
```

```
2130  07223  6151          6151    / Z
2131  07224  4543          4543
2132  07225  7741          7741    / [
2133  07226  0000          0
2134  07227  0204          204     / \
2135  07230  1020          1020
2136  07231  4177          4177    / ]
2137  07232  0000          0
2138  07233  0436          436     / ^
2139  07234  0400          400
2140  07235  0000          0       /SPECIAL CHARACTER (37)
2141  07236  7112          RESET   /RESET
2142  07237  0000          0       /SPECIAL CHARACTER (40)
2143  07240  7077          SPACE   /SPACE
2144  07241  5600          5600    / !
2145  07242  0000          0
2146  07243  0303          303     / "
2147  07244  0000          0
2148  07245  1477          1477    / #
2149  07246  7714          7714
2150  07247  2277          2277    / MARKER
2151  07250  2200          2200
2152  07251  2313          2313    / %
2153  07252  6462          6462
2154  07253  7777          7777    / BLOCK
2155  07254  7777          7777
2156  07255  0300          300     / '
2157  07256  0000          0
2158  07257  3641          3641    / (
2159  07260  0000          0
2160  07261  4136          4136    / )
2161  07262  0000          0
2162  07263  4040          4040    / UNDERSCORE (52)
2163  07264  4040          4040
2164  07265  1034          1034    / +
2165  07266  1000          1000
2166  07267  0000          0       /SPECIAL CHARACTER (54)
2167  07270  7104          LF      /LINE FEED
2168  07271  1010          1010    / -
2169  07272  1000          1000
2170  07273  4000          4000    / .
2171  07274  0000          0
2172  07275  2010          2010    / /
2173  07276  0402          402
2174  07277  3641          3641    / 0
2175  07300  4136          4136
2176  07301  4442          4442    / 1
2177  07302  7740          7740
2178  07303  4261          4261    / 2
2179  07304  5146          5146
2180  07305  2145          2145    / 3
2181  07306  5321          5321
2182  07307  1710          1710    / 4
2183  07310  1077          1077
2184  07311  4745          4745    / 5
```

```
2185  07312  4531          4531
2186  07313  7750          7750      / 6
2187  07314  5070          5070
2188  07315  6111          6111      / 7
2189  07316  0503          503
2190  07317  2255          2255      / 8
2191  07320  5522          5522
2192  07321  0705          705       / 9
2193  07322  0577          577
2194  07323  2400          2400      / :
2195  07324  0000          0
2196  07325  0000          0         /SPECIAL CHARACTER (73)
2197  07326  7102          CRLF      /CARRIAGE RETURN; LINE FEED
2198  07327  1024          1024      / >
2199  07330  4200          4200
2200  07331  1212          1212      / =
2201  07332  1200          1200
2202  07333  4224          4224      / <
2203  07334  1000          1000
2204  07335  0255          255       / ?
2205  07336  0300          300
2206
```

```
2207
2208                    /
2209                    /       HERE FOLLOW THE PACKED ASCII TEXTS FOR THE VARIOUS
2210                    /       VICTORY MESSAGES.  PERSONS ADVENTEROUS TO FIND THIS MIGH CARE
2211                    /       TO TOGGLE IN SOME CUTE LITTLE MESSAGES OF THEIR OWN.
2212                    /
2213
2214   07337  3773  MESS0,  3773
2215   07340  7340  MESS5,  7340
2216   07341  4040          4040
2217   07342  4040          4040
2218   07343  4000          4000
2219
2220   07344  1716  MESS1,  1716
2221   07345  0500          0500
2222
2223   07346  2427  MESS2,  2427
2224   07347  1700          1700
2225
2226   07350  2711  MESS3,  2711
2227   07351  1623          1623
2228   07352  4100          4100
2229
2230   07353  1617  MESS4,  1617
2231   07354  0217          0217
2232   07355  0431          0431
2233   07356  0000          0000
2234
```

```
2235
2236            7400            *7400
2237
2238    07400   0000    DISBUF, 0
2239
2240                    /       THE DISPLAY BUFFERS BEGIN HERE AND EXTEND UP SOMEWHERE TO
2241                    /       AROUND 7575 OR SO.
2242                    /
2243                    /
2244                    /
2245                    /
2246                    /
2247
```

```
2248
2249
2250                    $
```

```
SINNG2 6417
SINPOP 6410
SINPOS 6426
SINPSH 6453
SINTAB 6462
SKXK   6321
SPACE  7077
SPCHAR 7074
START  0200
STRT1  0307
STRT2  0310
SWRD   0311
TABLE  7136
TABLEN 0303
TERM   7116
THEADJ 0100
THEAJI 2475
TIEUP  2331
TIMOUT 2250
TWOLOP 1454
TWFG1  1376
TWFG2  1377
TWOCNT 0034
TWOCON 1332
TWOCOS 0044
TWODIS 1436
TWOEXP 2310
TWOFIG 0635
TWOFIL 0115
TWOFIN 0045
TWOFLG 0035
TWOLEF 0623
TWOLNC 0705
TWOLST 2252
TWOMOV 0651
TWOOK  0610
TWOOUT 0033
TWOPEX 0041
TWOPEY 0042
TWORTN 2255
TWORYT 0631
TWOSET 1200
TWOSIN 0043
TWOTHE 0036
TWOUP  0600
TWOVEL 0670
TWOVEX 0037
TWOVEY 0040
TWOWIN 2515
TWOWN  0754
T10COS 0060
T10SIN 0055
T20COS 0061
T20SIN 0056
T30COS 0062
T30SIN 0057
UPDATE 0250
VECTOR 0071
VEECLR 2470
VEEHLD 2472
VEELIM 2451
VEEMAX 2474
VEEMIN 2473
VEEPOS 2463
VEESCL 0101
VEESET 2260
WRDEND 7063
XINCR  7124
XONEDS 0046
XPLOT  7032
XRCL   6334
XRIN   6331
XROPT  0312
XTWODS 0050
XVALUE 7122
YINCR  7125
YONEDS 0047
YPLOT  7042
YTEMP  7126
YTWODS 0051
YVALUE 7123
ZTEN   6342
```

ACCFLG	0105	ENDGAM	1661	MES1	2542	ONETHE	0023
ACCPER	0106	EXIT	7070	MES2	2543	ONEUP	0400
ADDR	7130	EXPDIS	2400	MES3	2544	ONEVEL	0472
AUTO10	0010	EXPIRE	1662	MES4	2545	ONEVEX	0024
AUTO11	0011	EXPLOP	2417	MES5	2546	ONEVEY	0025
AUTO12	0012	FILDIS	1400	MEXP	0107	ONEWIN	2507
AUTO13	0013	FILONE	1421	MHYP	2257	ONEWN	0556
AUTO14	0014	FINISH	1647	MRES	1723	ONFG1	1154
AUTO15	0015	FINITO	2540	MULCMP	6661	ONFG2	1155
AUTO16	0016	FLAM1	1052	MULMPZ	6657	OP14	0752
AUTO17	0017	FLAM2	1263	MULMP1	6671	OP300	0554
BUFLIM	1673	GAMOVR	0104	MULMP2	6673	OTEN	6344
BUFSET	0302	HM177	2270	MULMP3	6674	OUTLOC	2256
BUFST	1672	HYPER	0076	MULMP4	6637	POINT	7135
BUFTMP	0113	HYPRET	2245	MULMP5	6672	POSCAL	6703
CALCOS	0064	HYPSET	2200	MULPSN	6653	PRODIS	1600
CALPOS	0072	IFILDS	1375	MULT	0067	PROLIF	0112
CALSIN	0063	INCONE	2333	MULTHR	6670	PROLOP	1604
CCF	6052	INCTWO	2334	MULTI	6621	PROX	0110
CHAR	7016	INITX	7120	M10	0134	PROY	0111
CHARS	7000	INITY	7121	M11	0135	P10	0117
CHECK	2000	INTACC	0346	M200	0137	P100	0124
CHECK2	2032	INTBUS	0326	M264	0136	P132	0125
CHKOUT	1674	INTCNT	0074	M4	0132	P17	0120
CLOCK	0075	INTGLH	0350	M400	0140	P20	0121
CLXK	6352	INTLNK	0347	M550	0141	P200	0126
CNTINU	7055	INTRET	0340	M6	0133	P37	0122
CODST	0265	INTSER	0313	NOWIN	2523	P3777	0131
COLDST	0251	INTTEM	0304	NOWPRO	2330	P40	0123
COLIDE	1472	INTWRD	0073	NOWTWO	2327	P400	0127
COLLID	2074	IONEEX	1473	ODT1	0004	P5	0116
COLLIM	2136	IONEST	0750	ODT2	0005	P550	0130
COSINE	0066	IPRODS	1464	ODT3	0006	RESCNT	1724
COSINI	6463	ISHFT	0102	OM14	0753	RESCON	1711
COUNT2	7132	ITWOEX	1474	OM300	0555	RESET	7112
COUNT6	7131	ITWOST	1153	ONECNT	0021	RESET1	0103
CRF	6072	ITWOUP	0552	ONECON	1121	RESE1	1675
CRLF	7102	IXPDIS	2332	ONECOS	0031	RESFND	1717
CURPLT	7127	JOBLOP	2527	ONEDIF	2251	RESLOP	1700
CUTOUT	2065	KM6	7133	ONEExP	2271	RESPNT	1725
CUTPNT	2073	K77	7134	ONEFIG	0437	RESTRT	0206
DIS	6304	LF	7104	ONEFIL	0114	RSHIFT	0070
DISBUF	7400	LFTHAF	0305	ONEFIN	0032	RTNFLG	2253
DISCNT	0054	LIMIT	2064	ONEFLG	0022	RYTHAF	0306
DISHFT	1535	LNC1FG	0553	ONELEF	0425	SETBUF	1726
DISLOP	1512	LNC2FG	0751	ONELNC	0507	SETLOP	1740
DISPLY	1475	MESOUT	0077	ONEMOV	0453	SETPNT	1747
DIXTEM	0052	MESS	2547	ONEOK	0410	SHIFTR	6675
DIYTEM	0053	MESS0	7337	ONEOUT	0020	SINARG	6452
DSB	6324	MESS1	7344	ONEPEX	0026	SINE	0065
DXC	6301	MESS2	7346	ONEPEY	0027	SINEIN	6400
DXL	6302	MESS3	7350	ONERTN	2254	SINELK	6444
DYC	6311	MESS4	7353	ONERYT	0433	SINES	6470
DYL	6312	MESS5	7340	ONESET	1000	SINLST	6454
EMPTY	0003	MES0	2541	ONESIN	0030	SINNEG	6423

```
MESOUT     187# 1680  1682  1684  1686
MESS       1661  1668  1674  1681  1695#
MESS0      1689  2214#
MESS1      1690  2220#
MESS2      1691  2223#
MESS3      1692  2226#
MESS4      1693  2230#
MESS5      1694  2215#
MES0       1679  1689#
MES1       1660  1690#
MES2       1667  1691#
MES3       1685  1692#
MES4       1673  1693#
MES5       1683  1694#
MEXP        195# 1322  1353  1409  1411  1466
MHYP       1458  1480#
MRES       1237  1262#
MULCMP     1905  1911#
MULMPZ     1908# 1917
MULMP1     1881  1892  1894  1902  1906  1912  1920#
MULMP2     1888  1897  1922#
MULMP3     1890  1900  1923#
MULMP4     1892# 1901
MULMP5     1882  1895  1899  1907  1913  1921#
MULPSN     1885  1904#
MULT        179#
MULTHR     1889  1919#
MULTI       179  1877# 1883  1908  1909
M10         219#  956
M11         220#
M200        222#  512   649
M264        221# 1741  1754
M4          217# 1107  1361  1564
M400        223# 1211
M550        224#  311  1639
M6          218#  803
NOWIN      1533  1673#
NOWPRO     1520  1530  1532#
NOWTWO     1501  1510  1531#
ODT1         86#
ODT2         87#
ODT3         88#
OM14        550   659#
OM300       414   522#
ONECNT      118#  804  1023
ONECON      759   762   770   803#
ONECOS      126#  264   439   453   505   508   704
ONEDIF     1430  1463  1474#
ONEEXP     1083  1495#
ONEFIG      408   424   431#
ONEFIL      201#  717  1021
ONEFIN      127#  269   402   545  1506  1527
ONEFLG      119#  397   403   699  1017  1298  1379  1474  1504
ONELEF      416   419#
ONELNC      480#
ONEMOV      446#
```