```
/SPCWAR  BY  D.E. WREGE
/                VERSION 3
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US&ID STCLK+4
US 0200
US XDISPL+12
US WARDX+6
US CLKINT

US OPTION+2

```
                /SPACE WAR. V3

                /D.E. WREGE


                /CONDITIONAL ASSEMBLY PARAMETERS

                /FOR AX08 TYPE DISPLAY DEFINE AX08=1
                        IFNDEF AX08 <AX08=0>
                /FOR TYPE 30G DISPLAY DEFINE T30G=1
                        IFNDEF T30G <T30G=0>
                /FOR PDP-8/E VC8E DISPLAY VC8E=1
                        IFNDEF VC8E <VC8E=0>
                /PDP-12 - VR12 IS DEFAULT
0001                    IFZERO VC8E+T30G+AX08 <PDP12=1>

                /CONDITIONAL ASSEMBLIES FOR CLOCK
                /FOR DK8-EA (60 CYCLE) DK8EA=1
                        IFNDEF DK8EA <DK8EA=0>
                /FOR DK8-EP PROGRAMABLE DK8EP=1
                        IFNDEF DK8EP <DK8EP=0>
                /FOR FRED DYER'S FUNNY CLOCK FCLOCK=1
                        IFNDEF FCLOCK <FCLOCK=0>
                /DEFAULT IS PDP-12 KW12-A
                        IFNZRO PDP12 <
                        IFZERO DK8EA+AX08+DK8EP+FCLOCK <
                        IFNDEF KW12 <KW12=1>>>


                /DEFS

                        IFNZRO PDP12 <
0140    DIS=    140         /DISPLAY A POINT LINC MODE
6141    LINC=   6141        /GO TO LINC MODE
0002    PDP=    0002        /GO TO 8-MODE>

7405    MUY=    7405        /EAE MULTIPLY
7407    DVI=    7407        /EAE DIVIDE
7411    NMI=    7411        /EAE NORMALIZE
7413    SHL=    7413        /EAE SHIFT LEFT
7415    ASR=    7415        /ARITHMETIC SHIFT RIGHT
7417    LSR=    7417        /LOGICAL SHIFT RIGHT
7421    MQL=    7421        /LOAD MQ;CLEAR AC
7403    SCL=    7403        /STEP COUNTER LOAD FROM MEMORY
7441    SCA=    7441        /STEP COUNTER TO ACCUMULATOR
7501    MQA=    7501        /READ MQ



0010    D=      10          /DISPLAY BUFFER FIELD
4000    DISBUF=4000         /ADDRESS OF DISPLAY BUFFER
```

VC8E=1

DK8EA=1

```
                /PAGE ZERO CONSTANTS AND VARIABLES

        0001    *1
00001   5777'            JMP INTRPT

        0006    *6
00006   0000    QBETA,   0                      /FOR PDP-12
00007   0000    QALPHA,  0                      /ALPHA REG USED FOR DISPLAY

00010   0000    QXR1,    0                      /RESERVED XR'S
00011   0000    QXR2,    0
00012   0000    QDISXR,  0                      /FOR DISPLAY ROUTINE ONLY
00013   0000    QXR3,    0                      /MUST BE USED WITH IOF

        0020    *20
                /VARIABLES RESERVED

00020   0000    QR,      0                      /SHIP POSITION RADIAL
00021   0000    ALIVE,   0                      /=0 WHEN SHIP BLOWN UP
                                                /NON-ZERO OTHERWISE
00022   0000    QXPOS,   0                      /X COORD.
00023   0000    QYPOS,   0                      /Y COORD.
00024   0000    QVX,     0                      /X COMPONENT VELOCITY
00025   0000    QVY,     0                      /Y COMPONENT VELOCITY
00026   0000    QPH,     0                      /SHIP ANGLE (NOT POSITION DEPENDENT)
00027   0000    QPHDOT,  0                      /SHIP ANGULAR VELOCITY
00030   0000    QPHR,    0                      /PRECISION QPH

00031   0000    SHIELD,  0                      /NON-ZERO WHEN SHIELDS ARE UP.
                                                /WHEN SHIELDS ARE UP NO MISSELS
                                                /AND NO ACCELLERATION ALLOWED.
00032   0000    HYPERS,  0                      /NON-ZERO WHEN IN HYPERSPACE
00033   0001    MISCNT,  1                      /-# MISSLES LEFT
00034   0000    ARMED,   0                      /INCREMENTS TO 0 BEFORE SHIP
                                                /CAN FIRE
00035   0000    QSHIP,   0                      /POINT TO SHIP PICTURE
00036   0000    QSHIPN,  0                      /# POINTS TO BE DISPLAYED IN SHIP
00037   0000    QSINPH,  0                      /SIN(QPH)
00040   0000    QCOSPH,  0                      /COS(QPH)
        0021            SHIPSZ=.-QR             /#ENTRIES/SHIP


00041   3777    QTIME,   3777                   /TIME SCALING FACTOR
                /TEMPS AND VARIABLES

00042   0000    QSINTH,  0                      /SIN(QTH)
00043   0000    QCOSTH,  0                      /COS(QTH)
00044   0000    BREAKU,  0                      /NON-ZERO WHEN SHIP BREAKING UP.
00045   0000    DBUFP,   0                      /POINTS TO NEXT POS IN DISP BUFF.
00046   0000    QTHR,    0                      /NON-ZERO WHEN MAIN ROCKETS ON
00047   0000    QTHA,    0                      /NON-ZERO WHEN ANGULAR THRUST ON
00050   0000    CONSER,  0                      /NON-ZERO IF CONSERVING ANGULAR
                                                 /MOMENTUM
00051   0000    NUMMIS,  0                      /# MISSELS IN MISTBL
00052   0000    NNUMMI,  0                      /TEMPORORY FOR UPDATING MISSLES
```

```
00053  0001  MAXMIS, -7777          /NUMBER OF ALLOWABLE MISSELS
00054  0000  QTM1,   0              /GENERAL TEMPORARYS
00055  0000  QTM2,   0
00056  0000  QCNT1,  0
00057  0000  QCNT2,  0
00060  0000  QCNT3,  0              /MUST BE USED WITH IOF

              /CONSTANTS

00061  0010  QTHRUS, 10             /THRUST
00062  1000  QGRAV,  1000           /GRAVITY
00063  0004  QRET,   4              /THRUST ANGULAR RETRO'S
00064  1000  QTHROC, 1000           /MUSSEL VELOCITY OF ROCKETS

              /THE FOLLOWING ARE POINTERS & FLAGS

00065  2200  PSAUCP, SAUC           /POINTER TO SAUCER SHIP GENERATOR
00066  4000  MISPNT, MISTBL         /POINTS TO WHERE NEXT MISSEL SHOULD
                                    /GO IN MISSEL TABLE
00067  1003  BOUNCX, NULL
00070  1003  BOUNCY, NULL

              /NEW INSTRUCTIONS

       4471           MULT=JMS I .
00071  0202           XMULT
       4472           DIVIDE=JMS I .
00072  0234           XDIVID
       4473           DISPLAY=JMS I .
00073  0260           XDISPL
       4474           COS=JMS I .      /COSINE LOOKUP
00074  0325           XCOSIN
       4475           SIN=JMS I .      /SINE LOOKUP
00075  0306           XSINE
       4476           GGRAV=JMS I .
00076  3050           XGGRAV
       4477           RANDOM=JMS I .
00077  0331           XRANDOM
       4500           ONDECK=JMS I .
00100  1600           XONDECK
       4501           OFDECK=JMS I .
00101  1616           XOFDECK
       4502           DRAW=JMS I .
00102  2000           CALPNT
       4503           NXTPOS=JMS I .
00103  2600           NEWPOS
       4504           NXTANG=JMS I .
00104  2662           ANGLES
       4505           FLAME=JMS I .
00105  3342           DFLAME
       4506           DSTARS=JMS I .
00106  3400           SUN
       4507           DSUN=JMS I .
```

```
00107  3454          POLARS
       4510          FIRE=JMS I .
00110  3600          FIRONE
```

```
                /THESE DEFS ARE ONLY FOR INTERMEDIATE
                /STAGES OF DEVELOPMENT.

                        IFDEF XXXXXX <  /OR IFPASS2
                        IFNDEF XONDECK <XONDECK=NULL1>
                        IFNDEF XOFDECK <XOFDECK=NULL1>
                        IFNDEF CALPNT <CALPNT=NULL1>
                        IFNDEF NEWPOS <NEWPOS=NULL1>
                        IFNDEF ANGLES <ANGLES=NULL1>
                        IFNDEF DFLAME <DFLAME=NULL1>
                        IFNDEF SUN <SUN=NULL1>
                        IFNDEF FIRONE <FIRONE=NULL1>
                        IFNDEF SAUC <SAUC=NULL1>
                        IFNDEF XGGRAV <XGGRAV=NULL1>
                        IFNDEF BOUNX <BOUNX=NULL1>
                        IFNDEF BOUNY <BOUNY=NULL1>
                        IFNDEF MISTBL <MISTBL=.>
                        IFNDEF SPCWAR <SPCWAR=.>>
        0111            XXXXXX=.
00111   7402            HLT

        0200            PAGE
```

```
                /SO WE HAVE START AT 200

00200  5601             JMP I .+1
00201  5200             SPCWAR

                /SIGNED MULTIPLY ROUTINE.
                /THIS ROUTINE DOES A INTEGER MULTIPLY OF
                /TWO SIGNED NUMBERS (11 BITS OF SIGNIF).
                /RESULT IS A SINGLE 12-BIT SIGNED NUMBER.
                /CALL:  TAD (MLTCAND
                /       JMS MULT
                /        MLTPLR

00202  0000  XMULT, 0
00203  7100          CLL                 /WILL SAVE IN LINK
00204  7510          SPA                 /MULTIPLICAND POSITIVE?
00205  7061          CMA CML IAC         /NO: MAKE POS. REMEMBER SIGN IN LINK
00206  7421          MQL                 /LOAD MULTIPLICAND INTO MQ
00207  1602          TAD I XMULT         /PICK UP MULTIPLIER
00210  2202          ISZ XMULT           /POINT TO RETURN
00211  7510          SPA                 /POSITIVE??
00212  7061          CMA CML IAC         /NO: MAKE POS AND REMEMBER SIGN
00213  3217          DCA XMULT1          /FOR THE MULTIPLY
00214  7044          CMA RAL             /AC=-1 IF NEG;-2 IF POS.
00215  3233          DCA XMULTS          /SAVE IT FOR LATER
00216  7405          MUY                 /EAE MULTIPLY
00217  0000  XMULT1,  0                  /MULTIPLYER GOES HERE
00220  7413          SHL                 /WANT CORRECT NORMALIZATION
00221  0000           0                  /ONE SHIFT ONLY
00222  3217          DCA XMULT1          /REMEMBER HIGH ORDER
00223  7501          MQA                 /READ LOW ORDER
00224  7710          SPA CLA             /SKIP IF NO ROUND UP
00225  7001          IAC                 /ROUND UP ONE
00226  1217          TAD XMULT1          /MAKE ROUNDED RESULT
00227  2233          ISZ XMULTS          /WILL SKIP IF NEG SIGN
00230  5602          JMP I XMULT         /DONE: AC=RESULT
00231  7041          CIA                 /NEGATE
00232  5602          JMP I XMULT         /AND RETURN

00233  0000  XMULTS, 0                   /SAVES SIGN OF RESULT

                /DIVISION OF SIGNED DIVIDEND BY UNSIGNED DIVISOR.
                /EXIT WITH 12-BIT SIGNED RESULT.
                /DIVIDE OVERFLOW ONLY OCCURS WHEN DIVISOR=0
                /CALL:  TAD (DIVIDEND
                /       DIVIDE
                /        DIVISOR
                /       ERROR           /DIVISION BY 0
                /       NORMAL RET.     /AC=SIGNED RESULT

00234  0000  XDIVID, 0
00235  7100          CLL                 /FOR SIGN
00236  7510          SPA                 /IS IT POSITIVE?
00237  7061          CIA CML             /NO:MAKE POS.
```

```
00240  7421          MQL             /PUT IN LOW ORDER
00241  7044          CMA RAL         /AC=-1 IF NEG.
00242  3233          DCA XMULTS      /SAVE SIGN
00243  1634          TAD I XDIVID    /GET DIVISOR
00244  2234          ISZ XDIVID      /POINT TO ERROR EXIT
00245  7450          SNA             /SKIP IF NOT ZERO
00246  5634          JMP I XDIVID    /TAKE DIV BY 0 RETURN
00247  2234          ISZ XDIVID      /POINT TO NORMAL RETURN
00250  3252          DCA .+2         /STORE DIVISOR
00251  7407          DVI             /DO THE DIVISION
00252  0000           0              /HOLDS THE DIVISOR
00253  7701          MQA CLA         /GET RESULT
00254  2233          ISZ XMULTS      /SKIP IF NEG
00255  5634          JMP I XDIVID    /POS=RETURN
00256  7041          CIA             /NEG=NEGATE
00257  5634          JMP I XDIVID    /AND RETURN
```

```
                /DISPLAY ROUTINE. REFRESHES OUT OF BUFFER IN FIELD D.
                /THIS IS FOR PDP-12 DISPLAY. USES QALPHA FOR REGISTER.
                /CALL:  TAD (ADDR-1     /ADDR=ADDRESS OF BUFFER IN FIELD D
                /       DISPLA          /OF X,Y PAIRS.
                /        -# POINTS

00260  0000  XDISPL, 0
00261  3012          DCA QDISXR        /ADDRESS INTO XR
00262  1660          TAD I XDISPL      /PICK UP # X,Y PAIRS
00263  2260          ISZ XDISPL        /POINT TO RETURN
00264  7450          SNA               /IF ZERO POINTS THEN EXIT
00265  5660          JMP I XDISPL
00266  7130          STL RAR           //2 FOR POINT PAIRS
00267  3056          DCA QCNT1         /STASH FOR COUNT
00270  6211          CDF D             /TO DISPLAY BUFFER FIELD
00271  6002          IOF               /FOR LINK MODE
                     IFNZRO PDP12 <
00272  1412  XDISL,  TAD I QDISXR      /GET THE X
00273  1377          TAD (400          /0 IS CENTER OF SCREEN
00274  3007          DCA QALPHA        /STICK IN ALPHA REGISTER
00275  1412          TAD I QDISXR      /GET Y-POSITION
00276  6141          LINC
00277  0147          DIS QALPHA        /DISPLAY THE POINT
00300  0002          PDP               /BACK TO 8-MODE
00301  7300          CLA CLL           /GET RID OF THE Y
                     >
                     IFNZRO T30G <
                     TAD (3            /MAX INTENSITY
                     6074              /SET MAX INTENSITY
                     CLA CLL
                XDISL, TAD I QDISXR    /GET X
                     CLL RAL           /512 RESOLUTION
                     TAD (1000         /TO CENTER OF SCREEN
                     6053              /CLEAR AND LOAD  X
                     CLA CLL
                     TAD I QDISXR      /GET Y
                     CLL RAL           /512 RESOLUTION
                     TAD (1000         /TO CENTER OF SCREEN
                     6067              /CLEAR AND LOAD Y;DISPLAY
                     CLA CLL
                     6161              /WAIT TILL DONE
                     JMP .-1)

                     IFNZRO VC8E <
                     6050              /CLEAR ALL FLAGS
                XDISL, TAD I QDISXR    /GET X
                     CLL RAL           /512 RESOLUTION
                     6053  6550        /CLEAR AND LOAD  X
                     CLA CLL
                     TAD I QDISXR      /GET Y
                     CLL RAL           /512 RESOLUTION
                     6054  6551        /CLEAR AND LOAD Y
                     CLA CLL
                     6055  6540        /INTENSIFY
                     6052              /WAIT TILL DONE
```

```
                        JMP .-1)
                        IFNZRO AX08 (
                XDISL,  TAD I QDISXR
                        TAD (400
                        6303            /LOAD X
                        CLA CLL
                        TAD I QDISXR    /GET Y
                        6317            /LOAD Y AND INTENS.
                        CLA CLL
                        )

00302   2056            ISZ QCNT1       /SKIP WHEN DONE
00303   5272            JMP XDISL       /LOOP
00304   6201            CDF 0           /BACK TO THIS FIELD
00305   5660            JMP I XDISPL    /AND RETURN


                /SINE LOOKUP ROUTINE.  ANGLES ARE IN
                /FRACTIONS OF A CIRCLE.  I.E. IN 256THS OF A CIRCL.
                /THUS PI RADIANS=200(8)
                /THE RESULT IS A SIGNED NUMBER -2048<SIN<2048.
                /NOTE THE NORMALIZATION.
                /CALL:  TAD (ANGLE
                /       SINE

00306   0000    XSINE,  0
00307   3054            DCA QTM1        /REMEMBER ANGLE
00310   1054            TAD QTM1        /GET BACK
00311   0376            AND (177        /INDEX INTO TABLE
00312   1377            TAD (SINTAB     /BY ADDING OFSET
00313   3055            DCA QTM2        /FOR INDIRECT
00314   1054            TAD QTM1        /NOW TO FIGURE OUT SIGN
00315   0375            AND (200        /BIT 4 INDICATES HEMISPHERE
00316   7100            CLL             /FOR HEMISPHERE INDICATOR
00317   7640            SZA CLA         /SKIP IF POS RESULT
00320   7120            STL             /NEG RESULT: INDICATE IN LINK
00321   1455            TAD I QTM2      /PICK UP VALUE
00322   7430            SZL             /SKIP IF POS.
00323   7041            CIA             /NEGATIVE SIGN
00324   5706            JMP I XSINE

                /DO THE SAME FOR COSINES

00325   0000    XCOSIN, 0
00326   1374            TAD (100        /OFFSET SO WE CAN USE SINE ROUTINE
00327   4306            JMS XSINE
00330   5725            JMP I XCOSIN    /AND RETURN

                /RANDOM NUMBER GENERATOR.
                /USES R(N+1)=(2^11+3)R(N-1) MODULO 24.
                /COULD BE LESS INTELEGENT FOR SPEED.
                /RESULT IS 12 BIT RANDOM NUMBER IN AC.

00331   0000    XRANDO, 0
00332   1355            TAD RANUML      /GET LOW ORDER
```

```
00333  7421           MQL              /MULTIPLICAND
00334  7405           MUY              /*2^11+3
00335  4003            4003
00336  3353           DCA RANUMT       /HIGH ORDER CARRY
00337  7501           MQA              /GET LOW ORDER
00340  3355           DCA RANUML       /STASH AS IS
00341  1354           TAD RANUMH       /GET HIGH ORDER
00342  7421           MQL
00343  7405           MUY              /*(2^11+3)
00344  4003            4003
00345  7200           CLA              /THROW AWAY HIGH ORDER
00346  7501           MQA              /READ MIDDLE ORDER
00347  1353           TAD RANUMT       /ADD OTHER PART
00350  3354           DCA RANUMH       /NEW HIGH ORDER
00351  1354           TAD RANUMH       /HIGH ORDER IS GOOD ONE
00352  5731           JMP I XRANDOM

00353  0000  RANUMT,  0
00354  0000  RANUMH,  0
00355  0001  RANUML,  1

00374  0100
00375  0200
00376  0177
00377  0400
       0400           PAGE
```

```
                        DECIMAL
00400  0000  SINTAB, 0;50;101;151;201;251;301;350;400;449
00401  0062
00402  0145
00403  0227
00404  0311
00405  0373
00406  0455
00407  0536
00410  0620
00411  0701
00412  0762  498;546;595;643;690;737;784;830;876;921
00413  1042
00414  1123
00415  1203
00416  1262
00417  1341
00420  1420
00421  1476
00422  1554
00423  1631
00424  1706  0966;1010;1053;1096;1138;1179;1220;1260;1299;1338
00425  1762
00426  2035
00427  2110
00430  2162
00431  2233
00432  2304
00433  2354
00434  2423
00435  2472
00436  2537  1375;1412;1448;1483;1518;1551;1583;1615;1645;1675
00437  2604
00440  2650
00441  2713
00442  2756
00443  3017
00444  3057
00445  3117
00446  3155
00447  3213
00450  3247  1703;1730;1757;1782;1806;1829;1851;1872;1892;1911
00451  3302
00452  3335
00453  3366
00454  3416
00455  3445
00456  3473
00457  3520
00460  3544
00461  3567
00462  3610  1928;1945;1960;1974;1987;1998;2009;2018;2026;2033
00463  3631
00464  3650
00465  3666
```

```
00466   3703
00467   3716
00470   3731
00471   3742
00472   3752
00473   3761
00474   3766   2038;2043;2046;2047;2047;2047;2046;2043;2038;2033
00475   3773
00476   3776
00477   3777
00500   3777
00501   3777
00502   3776
00503   3773
00504   3766
00505   3761
00506   3752   2026;2018;2009;1998;1987;1974;1960;1945;1928;1911
00507   3742
00510   3731
00511   3716
00512   3703
00513   3666
00514   3650
00515   3631
00516   3610
00517   3567
00520   3544   1892;1872;1851;1829;1806;1782;1757;1730;1703;1675
00521   3520
00522   3473
00523   3445
00524   3416
00525   3366
00526   3335
00527   3302
00530   3247
00531   3213
00532   3155   1645;1615;1583;1551;1518;1483;1448;1412;1375;1338
00533   3117
00534   3057
00535   3017
00536   2756
00537   2713
00540   2650
00541   2604
00542   2537
00543   2472
00544   2423   1299;1260;1220;1179;1138;1096;1053;1010;0966;0921
00545   2354
00546   2304
00547   2233
00550   2162
00551   2110
00552   2035
00553   1762
00554   1706
```

```
00555   1631
00556   1554   0876;0830;0784;0737;0690;0643;0595;0546;0498;0449
00557   1476
00560   1420
00561   1341
00562   1262
00563   1203
00564   1123
00565   1042
00566   0762
00567   0701
00570   0620   0400;0350;0301;0251;0201;0151;0101;0050
00571   0536
00572   0455
00573   0373
00574   0311
00575   0227
00576   0145
00577   0062

                       OCTAL
00600   0000   GRVTBL,  0
        1000   *.+177                    /RESERVED FOR GRAVITY TABLE

               /A LITTLE DO NOTHING SUBROUTINE

01000   0000   NULL1,   0
01001   7300            CLA CLL
01002   5603            JMP I NULL

               /WE NEED TWO OF THEM?????

01003   0000   NULL,    0
01004   5603            JMP I NULL
```

```
                        /ROCKET FLAME TABLE
                                DECIMAL
                        FLAMEX,
01005   7766            -10;0; -12;0; -14;0; -16;0; -20;0; -18;0; -20;0; -22;0
01006   0000
01007   7764
01010   0000
01011   7762
01012   0000
01013   7760
01014   0000
01015   7754
01016   0000
01017   7756
01020   0000
01021   7754
01022   0000
01023   7752
01024   0000

                        /SHIP OUTLINES
                        /SHIP 1   KLINGON BATTLE CRUISER (STAR TREK)
                        SHIP1C,
01025   0001            1;0; 3;0; 5;0; 7;0; 9;0; 10;1; 12;1; 13;1; 14;0
01026   0000
01027   0003
01030   0000
01031   0005
01032   0000
01033   0007
01034   0000
01035   0011
01036   0000
01037   0012
01040   0001
01041   0014
01042   0001
01043   0015
01044   0001
01045   0016
01046   0000
01047   0000            0;0; 0;1; -2;1; -3;2; -4;3; -5;4; -6;5; -7;6
01050   0000
01051   0000
01052   0001
01053   7776
01054   0001
01055   7775
01056   0002
01057   7774
01060   0003
01061   7773
01062   0004
01063   7772
01064   0005
```

```
01065   7771
01066   0006
01067   7767   -9;6; -11;6; -12;6; -11;5; -9;3; -7;1; -8;1
01070   0006
01071   7765
01072   0006
01073   7764
01074   0006
01075   7765
01076   0005
01077   7767
01100   0003
01101   7771
01102   0001
01103   7770
01104   0001
        1105            SHIP1E=.
01105   0015    13;-1
01106   7777
01107   0014   12;-1; 10;-1; -8;-1; -7;-1; -9;-3; -11;-5; -12;-6; -11;-6
01110   7777
01111   0012
01112   7777
01113   7770
01114   7777
01115   7771
01116   7777
01117   7767
01120   7775
01121   7765
01122   7773
01123   7764
01124   7772
01125   7765
01126   7772
01127   7767   -9;-6; -7;-6; -6;-5; -5;-4; -4;-3; -3;-2; -2;-1; 0;-1
01130   7772
01131   7771
01132   7772
01133   7772
01134   7773
01135   7773
01136   7774
01137   7774
01140   7775
01141   7775
01142   7776
01143   7776
01144   7777
01145   0000
01146   7777
01147   0001   1;0; 3;0; 5;0; 7;0; 9;0; 0;0
01150   0000
01151   0003
01152   0000
```

```
01153  0005
01154  0000
01155  0007
01156  0000
01157  0011
01160  0000
01161  0000
01162  0000
              /SHIP1E=.

01163  0011  SAUC1,  9;0; 10;0; 11;0; 3;0; -3;0; 0;3; 0;-3
01164  0000
01165  0012
01166  0000
01167  0013
01170  0000
01171  0003
01172  0000
01173  7775
01174  0000
01175  0000
01176  0003
01177  0000
01200  7775
       1201          SAUC1E=.

              /SHIP 2  FLASH GORDON
              SHIP2C,
01201  0016  14;0; 12;1; 10;2; 8;2; 6;2; 4;2; 2;2; 0;2; -2;2; -4;2; -6;2; -8;2;
01202  0000
01203  0014
01204  0001
01205  0012
01206  0002
01207  0010
01210  0002
01211  0006
01212  0002
01213  0004
01214  0002
01215  0002
01216  0002
01217  0000
01220  0002
01221  7776
01222  0002
01223  7774
01224  0002
01225  7772
01226  0002
01227  7770
01230  0002
01231  7770
01232  0000
01233  0004  4;4; 2;6; 0;8; -3;8; -2;7; 0;5; 0;3
```

```
01234   0004
01235   0002
01236   0006
01237   0000
01240   0010
01241   7775
01242   0010
01243   7776
01244   0007
01245   0000
01246   0005
01247   0000
01250   0003
        1251            SHIP2E=.
01251   0014   12;-1; 10;-2; 8;-2; 6;-2; 4;-2; 2;-2; 0;-2; -2;-2; -4;-2; -6;-2; -8
01252   7777
01253   0012
01254   7776
01255   0010
01256   7776
01257   0006
01260   7776
01261   0004
01262   7776
01263   0002
01264   7776
01265   0000
01266   7776
01267   7776
01270   7776
01271   7774
01272   7776
01273   7772
01274   7776
01275   7770
01276   7776
01277   0004   4;-4; 2;-6; 0;-8; -3;-8; -2;-7; 0;-5; 0;-3
01300   7774
01301   0002
01302   7772
01303   0000
01304   7770
01305   7775
01306   7770
01307   7776
01310   7771
01311   0000
01312   7773
01313   0000
01314   7775
                /SHIP2E=.

                /SAUCER CANNON
01315   0011   SAUC2, 9;0; 10;0; 11;0
01316   0000
```

```
01317   0012
01320   0000
01321   0013
01322   0000
        1323            SAUC2E=.

                /SAUCERS COMMON OUTLINE
                BSHIP,
01323   0000    0;112; 1;110; 2;106; 3;100; 4;91; 5;79
01324   0160
01325   0001
01326   0156
01327   0002
01330   0152
01331   0003
01332   0144
01333   0004
01334   0133
01335   0005
01336   0117
01337   0006    6;66; 6;51; 7;35; 7;18; 7;0
01340   0102
01341   0006
01342   0063
01343   0007
01344   0043
01345   0007
01346   0022
01347   0007
01350   0000
        1351            BSHIPE=.

                        OCTAL


                /SHIP DEPENDENT STUFF FOR PAGE ZERO LOAD

01351   0000    SHIP1,  ZBLOCK QSHIP-QR
01366   1315            SAUC2
01367   0006            SAUC2E-SAUC2
        0017            XXX=.-SHIP1
01370   0000            ZBLOCK SHIPSZ-XXX

        1353            SHIP1X=SHIP1+QXPOS-QR
        1354            SHIP1Y=SHIP1+QYPOS-QR

01372   0000    SHIP2,  ZBLOCK QSHIP-QR
01407   1315            SAUC2
01410   0006            SAUC2E-SAUC2
        0017            XXX=.-SHIP2
01411   0000            ZBLOCK SHIPSZ-XXX

        1374            SHIP2X=SHIP2+QXPOS-QR
        1375            SHIP2Y=SHIP2+QYPOS-QR
```

1600 PAGE

```
                /ONDECK ROUTINE.
                /THIS ROUTINE PUTS SHIP DEPENDENT STUFF
                /IN PAGE ZERO FOR COMMON CALCULATIONAL
                /ROUTINES.  ENTER WITH TABLE ADD-1 IN AC.
                /COPIES "SHIPSZ" LOCATIONS.

                /CALL:  TAD (SHIPST-1
                /       ONDECK
                /       RETURN

01600   0000    XONDEC, 0
01601   3011            DCA QXR2        /ADDRESS OF SHIP STUFF
01602   1377            TAD (QR-1       /START OF PAGE ZERO LOCS.
01603   3010            DCA QXR1        /STICK IN OTHER XR
01604   4206            JMS SWITCH      /PUT IT THERE
01605   5600            JMP I XONDECK

                /TAKE STUFF FROM XR2 AND PUT IN XR1

01606   0000    SWITCH, 0
01607   1376            TAD (-SHIPSZ    /NUMBER OF ENTRIES
01610   3056            DCA QCNT1
01611   1411            TAD I QXR2      /SOURCE
01612   3410            DCA I QXR1      /DESTINATION
01613   2056            ISZ QCNT1       /DONE?
01614   5211            JMP .-3         /NOT YET
01615   5606            JMP I SWITCH

                /OFDECK ROUTINE.
                /COPY STUFF OUT. (INVERSE OF ONDECK)
                /CALL:  TAD (SHIPST-1
                /       OFDECK
                /        RETURN

01616   0000    XOFDEC, 0
01617   3010            DCA QXR1                /DESTINATION XR
01620   1377            TAD (QR-1       /START OF PAGE ZERO STUFF
01621   3011            DCA QXR2                /SOURCE XR
01622   4206            JMS SWITCH      /COPY IT OUT
01623   5616            JMP I XOFDECK   /AND RETURN
```

```
01776  7757
01777  0017
       2000             PAGE
                /ROUTINE TO CALCULATE THE SHIP OUTLINE FROM CENTRAL
                /COORDINATES AND OUTLINE.  REQIRES THE FOLLOWING PAGE 0'S
                /BE PREVIOUSLY SET UP:
                /       QXPOS   X-CORD CENTER OF SHIP
                /       QYPOS   Y-CORD CENTER OF SHIP
                /       QSINPH  SINE OF SHIP ANGLE FROM X AXIS
                /       QCOSPH  COS  OF SHIP ANGLE FROM X AXIS
                /       QSHIP   POINTS TO START OF SHIP OUTLINE TABLE
                /       QSHIPN  NUMBER OF POINTS IN SHIP OUTLINE
                /       QTIME   OUTLINE SCALE FACTOR

                /IF SHIP IS NOT ALIVE OR IN HYPERSPACE THEN FAST EXIT.
                /COSINES AND SIGNS MUST ALLREADY BE AVAILABLE.
                /ALGORITHM:
                /       X=QXPOS + XS*COS(PH) - YS*SIN(PH)
                /       Y=QYPOS + XS*SIN(PH) + YS*COS(PH)
                /WHERE XS AND YS ARE POINTS ON SHIP OUTLINE FROM QSHIP TABLE.
                /THIS ROUTINE MAKES USE OF SYMMETRY

02000  0000  CALPNT, 0
02001  1032          TAD HYPERS      /GET HYPERSPACE FLAG
02002  7640          SZA CLA         /SKIP IF VISIBLE
02003  5600          JMP I CALPNT    /CAN'T SEE HIM
02004  1021          TAD ALIVE       /NOW SEE IF ALIVE
02005  7650          SNA CLA         /SKIP IF ALIVE AND WELL
02006  5600          JMP I CALPNT    /HAS BIT THE DUST
02007  1036          TAD QSHIPN      /NUMBER OF POINTS IN SHIP
02010  7161          CIA STL         /NEGATE
02011  7010          RAR             /POINT PAIRS
02012  3056          DCA QCNT1       /-# POINT PAIRS.
02013  7240          STA             /SINCE USING XR
02014  1035          TAD QSHIP       /WANT START-1
02015  3010          DCA QXR1        /STASH IN XR
02016  1041          TAD QTIME       /GET THE TIME SCALER
02017  3222          DCA T1          /SET IT UP FOR A MULT
02020  1040          TAD QCOSPH      /GET COS
02021  4471          MULT            /SCALE IT
02022  0000  T1,      0
02023  3271          DCA CALPX1      /SET IT UP FOR OUTLINE CALC
02024  1041          TAD QTIME       /DO THE SAME FOR -SIN
02025  3231          DCA T2
02026  1037          TAD QSINPH
02027  7041          CIA
02030  4471          MULT
02031  0000  T2,      0
02032  3275          DCA CALPY1
02033  1037          TAD QSINPH
02034  7510          SPA
02035  7041          CIA
02036  3322          DCA CALPY3
02037  1022          TAD QXPOS       /MUST SCALE X RIGHT
02040  7415          ASR             /TWO TO THE RIGHT
```

```
02041  0002            2
02042  3356            DCA CALPTX      /STORE FOR LATER
02043  1023            TAD QYPOS       /AND THE SAME FOR Y
02044  7415            ASR
02045  0002            2
02046  3357            DCA CALPTY
02047  1041            TAD QTIME       /SCALE SINE AND COS FOR THE
02050  3253            DCA T3          /Y COMPONENT OF SHIP OUTLINE
02051  1037            TAD QSINPH
02052  4471            MULT
02053  0000  T3,        0
02054  3310            DCA CALPX2
02055  1041            TAD QTIME
02056  3261            DCA T4
02057  1040            TAD QCOSPH
02060  4471            MULT
02061  0000  T4,        0
02062  3314            DCA CALPY2
02063  1410  CALPL,     TAD I QXR1      /GET X POINT
02064  3353            DCA CALPX       /AND STASH
02065  1410            TAD I QXR1      /GET Y POINT
02066  3354            DCA CALPY       /AND STASH
02067  1353            TAD CALPX       /GET X
02070  4471            MULT            /MULTIPLY
02071  0000  CALPX1,     0
02072  3355            DCA CALPT       /STORE TILL LATER
02073  1354            TAD CALPY       /GET Y
02074  4471            MULT
02075  0000  CALPY1,    0             /-XY*SIN(PH)
02076  3361            DCA CALPY4      /SAVE IT FOR SYM CALC
02077  1361            TAD CALPY4      /AND GET IT BACK
02100  1355            TAD CALPT       /XS*COS(PH)-YS*SIN(PH)
02101  1356            TAD CALPTX      /AND IN CENTER OF SHIP
02102  6211            CDF B           /TO DISPLAY FIELD
02103  3445            DCA I DBUFP     /INTO DISPLAY BUFFER
02104  2045            ISZ DBUFP
02105  6201            CDF 0
02106  1353            TAD CALPX
02107  4471            MULT
02110  0000  CALPX2,    0             /XS*SIN(PH)
02111  3360            DCA CALPT2      /STASH
02112  1354            TAD CALPY       /GET Y VALUE
02113  4471            MULT
02114  0000  CALPY2,    0             /YS*COS(PH)
02115  3362            DCA CALPY5      /SAVE IT FOR SYM CALC
02116  1362            TAD CALPY5      /AND GET IT BACK
02117  1360            TAD CALPT2      /XS*SIN(PH)+YS*COS(PH)
02120  7000  PSAUC2,   NOP             /OR JMP .+3 FOR SHIPS
02121  4471            MULT
02122  0000  CALPY3,    0
02123  1357            TAD CALPTY      /YPOS+XS*SIN(PH)+YS*COS(PH)
02124  6211            CDF D           /TO DISPLAY FIELD
02125  3445            DCA I DBUFP     /STICK IN BUFFER
02126  2045            ISZ DBUFP       /NEXT POSITION
02127  6201            CDF 0           /BACK TO THIS FIELD
```

```
02130  1361           TAD CALPY4      /GET -Y*SIN(PH)
02131  7041           CIA             /NEGATE IT
02132  1355           TAD CALPT       /ADD XS*COS(PH)
02133  1356           TAD CALPTX      /ADD CENTER OF SHIP
02134  6211           CDF D           /CHANGE TO DISPLAY FIELD
02135  3445           DCA I DBUFP     /AND DEPOSIT IT
02136  2045           ISZ DBUFP
02137  6201           CDF 0           /RESTORE DATA FIELD
02140  1362           TAD CALPY5      /GET YS*COS(PH)
02141  7041           CIA             /AND NEGATE IT
02142  1360           TAD CALPT2      /ADD TO IT XS*SIN(PH)
02143  1357           TAD CALPTY      /ADD ON SHIP CENTER
02144  6211           CDF D           /CHANGEO DISPLAY FIELD
02145  3445           DCA I DBUFP     /AND DEPOSIT T
02146  2045           ISZ DBUFP
02147  6201           CDF 0
02150  2056           ISZ QCNT1       /CHECK FR COMPLETION
02151  5263           JMP CALPL       /LOOP
02152  5600           JMP I CALPNT

02153  0000  CALPX,    0
02154  0000  CALPY,    0
02155  0000  CALPT,    0
02156  0000  CALPTX,   0
02157  0000  CALPTY,   0
02160  0000  CALPT2,   0
02161  0000  CALPY4,   0
02162  0000  CALPY5,   0

       2200           PAGE
```

```
                /THIS IS FOR SHIPS BEING SAUCERS
                /REPLACES CALPNT WHEN USING SAUCERS.

02200  0000  SAUC,   0
02201  1032          TAD HYPERS        /DON'T DO IT IF
02202  7640          SZA CLA           /IN HYPERSPACE
02203  5600          JMP I SAUC
02204  1377          TAD (BSHIP-1      /INDEX INTO SAUCER TABLE
02205  3010          DCA QXR1
02206  1041          TAD QTIME         /FOR CURVED SPACE
02207  3212          DCA .+3           /WE SCALE DOWN ANGLES
02210  1037          TAD QSINPH        /GET ANGLE
02211  4471          MULT
02212  0000           0                /SCALE IT DOWN
02213  3237          DCA SALPN1        /FOR MULTIPLY
02214  1376          TAD (BSHIP-BSHIPE /LENGTH
02215  7130          STL RAR           / DIVIDE BY 2
02216  3056          DCA QCNT1         /NUMBER OF LOOPS
02217  1022          TAD QXPOS         /SHIFT OVER NOW
02220  7415          ASR;2             /TO FIT ON SCREEN
02221  0002
02222  3314          DCA SALPTX
02223  1023          TAD QYPOS         /AND THE SAME FOR Y
02224  7415          ASR;2
02225  0002
02226  3315          DCA SALPTY
02227  1041          TAD QTIME
02230  3233          DCA SALPN2        /FOR OTHER SCALE DOWN
02231  1410  SALPNL, TAD I QXR1        /GET AN X
02232  4471          MULT
02233  0000  SALPN2,  0               /SCALE DOWN
02234  3316          DCA SALPX         /STORE
02235  1410          TAD I QXR1        /GET Y
02236  4471          MULT
02237  0000  SALPN1,  0
02240  7415          ASR;3
02241  0003
02242  3317          DCA SALPY
02243  6211          CDF D
02244  1316          TAD SALPX
02245  1314          TAD SALPTX
02246  3445          DCA I DBUFP
02247  2045          ISZ DBUFP
02250  1317          TAD SALPY
02251  1315          TAD SALPTY
02252  3445          DCA I DBUFP
02253  2045          ISZ DBUFP
02254  1316          TAD SALPX
02255  1314          TAD SALPTX
02256  3445          DCA I DBUFP
02257  2045          ISZ DBUFP
02260  1317          TAD SALPY
02261  7041          CIA
02262  1315          TAD SALPTY
02263  3445          DCA I DBUFP
```

```
02264  2045           ISZ DBUFP
02265  1316           TAD SALPX
02266  7041           CIA
02267  1314           TAD SALPTX
02270  3445           DCA I DBUFP
02271  2045           ISZ DBUFP
02272  1317           TAD SALPY
02273  1315           TAD SALPTY
02274  3445           DCA I DBUFP
02275  2045           ISZ DBUFP
02276  1316           TAD SALPX
02277  7041           CIA
02300  1314           TAD SALPTX
02301  3445           DCA I DBUFP
02302  2045           ISZ DBUFP
02303  1317           TAD SALPY
02304  7041           CIA
02305  1315           TAD SALPTY
02306  3445           DCA I DBUFP
02307  2045           ISZ DBUFP
02310  6201           CDF 0
02311  2056           ISZ QCNT1
02312  5231           JMP SALPNL
02313  5600           JMP I SAUC

02314  0000  SALPTX,  0
02315  0000  SALPTY,  0
02316  0000  SALPX,   0
02317  0000  SALPY,   0
```

```
                /ROUTINE TO ADD TWO NUMBERS(REALLY!!!)
                /CHECKING FOR SCOPE WRAP AROUND.
                /TAKES TWO RETURNS DEPENDING ON WHETHER WRAP OCCURS
                /FROM 3777 TO 4000 AND 4000 TO 3777.
                /ALGORITHM:
                /       1. ONLY HAVE TROUBLE IF ADDING NUMBERS OF SAME SIGN
                /       2. IF SAME SIGN ARE OK IF LINK OVERFLOW MATCHES
                /          SIGN BIT.

                /CALL:  TAD NUMB1       /MAIN NUMBER
                /       JMS I (XADDD
                /        NUMB2          /INCREMENT
                /       RET1            /RETURN IF WRAP AROUND
                /       RET2            /NO WRAP.
                /BOTH RETURNS ARE WITH AC=NUMB1+NUMB2

02320   0000    XADDD,  0
02321   3345            DCA XADDD1      /STASH NUMB1
02322   1345            TAD XADDD1      /GET BACK
02323   7004            RAL             /SIGN BIT IN LINK
02324   7200            CLA             /TO GET NUMB2
02325   1720            TAD I XADDD     /GET NUMB2
02326   7510            SPA             /SKIP IF NUMB2 POS
02327   7020            CML             /NUMB2 NEG SO COMPLEMT LINK
02330   7430            SZL             /SKIP IF SIGNS NOT THE SAME
02331   5341            JMP XADDD2      /ALL OK.
02332   1345            TAD XADDD1      /AC=NUMB1+NUMB2
02333   7510            SPA             /SKIP IF RESULT POSITIVE
02334   7020            CML             /RESULT NEG COMP LINK FOR TEST
02335   7420            SNL             /SKIP IF WRAP OCCURRED
02336   2320            ISZ XADDD       /TAKE SECOND RETURN
02337   2320            ISZ XADDD       /UPDATE RETURN
02340   5720            JMP I XADDD

02341   1345    XADDD2, TAD XADDD1
02342   2320            ISZ XADDD
02343   2320            ISZ XADDD
02344   5720            JMP I XADDD

02345   0000    XADDD1, 0


                /ROUTINE TO BOUNCE X

02346   0000    BOUNX,  0
02347   7300            CLA CLL         /GET RID OF THE BAD QXPOS
02350   1024            TAD QVX
02351   7041            CIA
02352   3024            DCA QVX
02353   2346            ISZ BOUNX       /PAST DCA QXPOS
02354   5746            JMP I BOUNX

                /AND Y

02355   0000    BOUNY,  0
```

```
02356  7300          CLA CLL          /GET RID OF THE BAD QYPOS
02357  1025          TAD QVY
02360  7041          CIA
02361  3025          DCA QVY
02362  2355          ISZ BOUNY        /PAST DCA QYPOS
02363  5755          JMP I BOUNY

02376  7752
02377  1322
       2400          PAGE
```

```
                /TIME SCALE FACTOR LOOKUP ROUTINE

02400   0000    LOOKUP, 0
02401   7510            SPA             /IF NEGATIVE,MAKE IT POSITIVE
02402   7041            CIA
02403   7417            LSR             /TAKE THE SPACE POINT
02404   0004            4               /AND SCALE IT TO FIT
02405   1377            TAD (TABLE      /INDEX INTO TABLE
02406   3211            DCA OFFSET
02407   1611            TAD I OFFSET
02410   5600            JMP I LOOKUP
02411   0000            OFFSET,0


                /CURVED SPACE TABLE, 64 POINTS (HALF SCREEN)

                        DECIMAL
02412   3777    TABLE,  2047;2047;2047;2047
02413   3777
02414   3777
02415   3777
02416   3777            2047;2047;2047;2047
02417   3777
02420   3777
02421   3777
02422   3777            2047;2047;2047;2047     /FLAT IN THE
02423   3777
02424   3777
02425   3777
02426   3777            2047;2047;2047;2047     /CENTER
02427   3777
02430   3777
02431   3777
02432   3774            2044;2040;2025;2010
02433   3770
02434   3751
02435   3732
02436   3720            2000;1990;1970;1950;
02437   3706
02440   3662
02441   3636
02442   3605            1925;1900;1875;1850;
02443   3554
02444   3523
02445   3472
02446   3434            1820;1790;1750;1710
02447   3376
02450   3326
02451   3256
02452   3174            1660;1610;1550;1500
02453   3112
02454   3016
02455   2734
02456   2553            1387;1325;1212;1100
02457   2455
```

```
02460   2274
02461   2114
02462   1750            1000;900;800;700
02463   1604
02464   1440
02465   1274
02466   1161            625;550;500;450
02467   1046
02470   0764
02471   0702
02472   0620            400;350;287;225
02473   0536
02474   0437
02475   0341
02476   0271            185;150;125;100
02477   0226
02500   0175
02501   0144
02502   0113            75;50;47;46             /IT LEVELS OUT
02503   0062
02504   0057
02505   0056
02506   0055            45;45;45;45             /NEAR INFINITY
02507   0055
02510   0055
02511   0055
02512   0055            45;45;45;45
02513   0055
02514   0055
02515   0055
                        OCTAL
02577   2412
        2600            PAGE
```

```
                /THIS ROUTINE IS TO CALCULATE THE NEW POSITIONS
                /AND VELOCITIES OF A POINT ON SCREEN UNDER THE
                /INFLUENCE OF A THRUST AND GRAVITY.
                /THE ALGORITHM IS WIERD, MAINLY BECAUSE I PROBABLY
                /HAVE NOT FIGURED OUT THE GOOD WAY TO DO IT BUT, HERE
                /IS HOW THE CALCULATION PROCEEDS:
                /  1.   ACCELLERATION DUE TO GRAVITY IS CALCULATED VIA
                /       THE ROUTINE GGRAV.  THIS ROUTINE SETS UP
                /       QSINTH_SIN(TH)/R
                /       QCOSTH_COS(TH)/R
                /       AC_-QGRAV/R FROM LOOKUP TABLE
                /       WHERE TH=ANGLE WITH SUN AND R=SQROOT(X^2+Y^2)
                /  2.   NEW VALUES FOR THE COMPONENTS OF VELOCITY IS COMPUTED
                /       FROM QVX_QVX+QTHR*COS(PH)-GRAV*SIN(TH)
                /            QVY_QVY+QTHR*SIN(PH)-GRAV*COS(TH)
                /  3.   NEW VALUES OF X,Y ARE COMPUTED
                /       QXPOS_QXPOS+QVX*(SCALE FACTOR)
                /       QYPOS_QYPOS+QVY*(SCALE FACTOR)
                /ALSO DOES WRAP-AROUND CHECKS AND BOUNCE IF ON.

02600  0000  NEWPOS, 0
02601  4476         GGRAV          /GET GRAVITY VALUE
02602  3207         DCA NEWPO1
02603  1207         TAD NEWPO1
02604  3225         DCA NEWPO2
02605  1043         TAD QCOSTH
02606  4471         MULT           /WE ARE DOING 1/R GRAVITY
02607  0000  NEWPO1,  0
02610  3207         DCA NEWPO1
02611  1046         TAD QTHR       /THRUST ON
02612  7450         SNA            /SKIP IF ON
02613  5220         JMP NEWPO3+1   /NO: DON'T CALCULATE
02614  3217         DCA NEWPO3
02615  1040         TAD QCOSPH
02616  4471         MULT
02617  0000  NEWPO3,  0            /T*COS(PH)
02620  1207         TAD NEWPO1     /T*COS(PH)+GRAVX
02621  1024         TAD QVX        /+OLD VELOCITY COMP.
02622  3024         DCA QVX
02623  1042  NEWPO6, TAD QSINTH
02624  4471         MULT
02625  0000  NEWPO2,  0
02626  3225         DCA NEWPO2
02627  1046         TAD QTHR       /GET ROCKET THRUST
02630  7450         SNA            /SKIP IF ON
02631  5236         JMP NEWPO4+1   /NOT ON: SAVE TIME
02632  3235         DCA NEWPO4
02633  1037         TAD QSINPH
02634  4471         MULT           /T*SIN(PH)
02635  0000  NEWPO4,  0
02636  1225         TAD NEWPO2     /T*SIN(PH)+GRAVY
02637  1025         TAD QVY        /+OLD VELOCITY COMPONENT
02640  3025         DCA QVY        /SAVE.

                    /NOW TO CALCULATE NEW X,Y
```

```
        4315            SC=JMS SCALE    /OPTIONAL FLAT OR CURVED
        4777'           SC1=JMS SCALE1
        4776'           SC2=JMS SCALE2
02641   1024    NEWP07, TAD QVX
02642   4315            JMS SCALE       /SCALE IF REQUIRED
02643   3246            DCA .+3         /FOR WRAP CHECK
02644   1022            TAD QXPOS       /ADD OLD POSITION
02645   4775            JMS I (XADDD    /ADD THEM
02646   0000             0
02647   4467            JMS I BOUNCX    /BOUNCE X IF IMPLEMENTED
02650   3022            DCA QXPOS       /UPDATE TO NEW POSITION
02651   1025            TAD QVY         /GET Y VELOCITY
02652   4315            JMS SCALE       /SCALE IF REQUIRED
02653   3256            DCA .+3
02654   1023            TAD QYPOS       /ADD OLD POSITION
02655   4775            JMS I (XADDD
02656   0000             0
02657   4470            JMS I BOUNCY    /BOUNCE IF IMPLEMENTED
02660   3023            DCA QYPOS       /UPDATE POSITION.
02661   5600            JMP I NEWPOS    /RETURN

                        /AND NEW ANGLE PHI

02662   0000    ANGLES, 0
02663   1050            TAD CONSER      /CHECK IF CONSERVING ANGULAR MOMENTUM
02664   7650            SNA CLA         /SKIP IF YES
02665   5271            JMP NEWP05      /NO:
02666   1047            TAD QTHA
02667   1027            TAD QPHDOT
02670   5275            JMP NEWP08
02671   7621    NEWP05, CLA MQL          /CLEAR MQ
02672   1047            TAD QTHA
02673   7413            SHL
02674   0003             3
02675   3027    NEWP08, DCA QPHDOT
02676   1027            TAD QPHDOT
02677   1030            TAD QPHR
02700   3030            DCA QPHR
02701   1030            TAD QPHR
02702   7415            ASR
02703   0003             3
02704   0374            AND (377        /ALL THAT MATTERS
02705   3026            DCA QPH         /TO NEW VALUE

02706   1026            TAD QPH         /MAKE SINE AND COS
02707   4475            SIN
02710   3037            DCA QSINPH      /SAVE SINE
02711   1026            TAD QPH
02712   4474            COS
02713   3040            DCA QCOSPH      /AND COS
02714   5662            JMP I ANGLES    /AND RETURN

                /ROUTINE TO SCALE VELOCITY
```

```
02715  0000  SCALE,  0
02716  4472         DIVIDE
02717  0016          16
02720  7000         NOP
02721  5715         JMP I SCALE


02774  0377
02775  2320
02776  3035
02777  3000
       3000         PAGE
                /CURVED VELOCITY SCALER ROUTINES
                /THE TIME SCALE FACTOR IS LOOKED UP AS
                /A FUNCTION OF THE LARGER COMPONENT OF
                /DISTANCE TO THE CENTER OF THE SHIP FROM
                /MID-SCREEN.  X AND Y VELOCITY COMPONENTS
                /ARE THEN SCALED BY HIS FACTOR.

03000  0000  SCALE1, 0
03001  7300         CLA CLL
03002  1022         TAD QXPOS        /GET THE CENTER OFHE SHIP
03003  7510         SPA              /IF NEGATIVE, MAKE IT POSITIVE
03004  7041         CIA
03005  3234         DCA COMPAR       /SAVE IT
03006  1023         TAD QYPOS        /GET THE Y COMPONENT
03007  7500         SMA              /MAKE SURE IT'S NEGATIVE
03010  7041         CIA
03011  1234         TAD COMPAR       /COMPARE IT WITH THE X COMP
03012  7620         SNL CLA
03013  5217         JMP .+4
03014  7200         CLA              /IF QXPOS IS THE LARGER COMP
03015  1022         TAD QXPOS        /THEN PUT IT IN HE AC
03016  5221         JMP .+3          /AND JMP TO LOOKUP
03017  7200         CLA              /OTHERWISE, PUT QYPOS IN AC
03020  1023         TAD QYPOS
03021  4777'        JMS LOOKUP       /AMD JMP TO LOOKUP
03022  3041         DCA QTIME        /SAVE THE TIME SCALE FACTOR
03023  1041         TAD QTIME
03024  3227         DCA TX           /SET IT UP FOR A MULT
03025  1024         TAD QVX
03026  4471         MULT             /MULTIPLY VELOCITY BY QTIME
03027  0000  TX,     0
03030  4472         DIVIDE           /SCALE IT DOWN
03031  0016         16
03032  7000         NOP
03033  5600         JMP I SCALE1
03034  0000         COMPAR,0

03035  0000  SCALE2, 0
03036  7200         CLA
03037  1041         TAD QTIME        /GET THE SCALE FACTOR
03040  3243         DCA TY
03041  1025         TAD QVY          /GET THE Y VELOCITY
```

```
03042  4471           MULT            /MULTIPLY IT BY QTIME
03043  0000  TY,      0
03044  4472           DIVIDE          /SCALE IT DOWN
03045  0016           16
03046  7000           NOP
03047  5635           JMP I SCALE2

               /ROUTINE TO GET GRAVITY CONSTANT FOR CURRENT X,Y POSITION.
               /IS TABLE LOOKUP ON X^2+Y^2 IN GRVTBL.

03050  0000  XGGRAV, 0
03051  4776'          JMS NEWPOL      /GET SIN(TH)/R ETC.
03052  1020           TAD QR          /GET R^2
03053  7417           LSR             /SCALE DOWN A LITTLE
03054  0002            2
03055  1375           TAD (GRVTBL     /INDEX INTO TABLE
03056  3261           DCA XSQUAR      /STORE FOR INDIRECT
03057  1661           TAD I XSQUAR    /GET VALUE
03060  5650           JMP I XGGRAV    /AND RETURN

03061  0000  XSQUAR, 0

               /THIS ROUTINE IS TO CALCULATE THE GRAVITY TABLE
               /TO BE USED BY XGGRAV.  THE LOOKUP IS VIA (X^2+Y^2)
               /TO INDEX INTO THE TABLE.  THEREFORE THE TABLE
               /IS STORED BY R^2 VALUE (128 POSITIONS BIG)

03062  0000  SETGRV, 0
03063  1374           TAD (GRVTBL-1   /SET XR TO GRAVITY TABLE
03064  3013           DCA QXR3        /FOR STORING
03065  3306           DCA SETGR1      /IS R-SQUARE
03066  1373           TAD (-177       /THIS MANY POINTS
03067  3060           DCA QCNT3
03070  3413           DCA I QXR3      /AS FIRST IS 0
03071  2306  SETGRL, ISZ SETGR1      /NEXT R-SQUARE
03072  1306           TAD SETGR1
03073  4772'          JMS ROOT        /TAKE SQUARE ROOT
03074  3277           DCA SETGRX      /FOR DIVIDE
03075  1062           TAD QGRAV       /GET GRAVITY CONSTANT
03076  4472           DIVIDE
03077  0000  SETGRX,  0
03100  7000           NOP             /CAN'T GET DIVIDE BY 0
03101  7041           CIA             /STORE NEGATIVE VALUES
03102  3413           DCA I QXR3      /STASH IN TABLE
03103  2060           ISZ QCNT3       /DONE?
03104  5271           JMP SETGRL      /NO. CONTINUE
03105  5662           JMP I SETGRV

03106  0000  SETGR1, 0

03172  3307
03173  7601
03174  0577
03175  0600
03176  3200
```

```
03177   2400
        3200            PAGE
```

```
                /THIS ROUTINE LOADS UP QSINTH AND QCOSTH
                /WITH NUMBERS PROPORTIONAL TO SIN(TH)/R
                /AND COS(TH)/R.  COUPLED WITH "GGRAV"
                /WHICH LOOKS UP A VALUE PROPORTIONAL TO
                /QGRAV/R RESULTS IN THE GRAVITY COMPONENTS
                /THE CALCULATION USES EXTENDED PRESISION

03200  0000  NEWPOL, 0
03201  1022         TAD QXPOS
03202  7510         SPA
03203  7041         CIA              /ABS VALUE OF X
03204  3210         DCA NEWPL1
03205  1210         TAD NEWPL1       /CALC X^2
03206  7421         MQL              /LOAD MULTIPLICAND
03207  7405         MUY              /USE EAE DIRECTLY
03210  0000  NEWPL1,  0
03211  3304         DCA NEWPLH       /STASH HIGH ORDER X^2
03212  7501         MQA              /GET LOW ORDER
03213  3305         DCA NEWPLL       /SAVE FOR NOW
03214  1023         TAD QYPOS        /GET Y
03215  7510         SPA
03216  7041         CIA              /TAKE ABS. VALUE
03217  3223         DCA NEWPL6       /TO CALCULATE
03220  1223         TAD NEWPL6       /Y^2
03221  7421         MQL              /LOAD MULTIPLICAND
03222  7405         MUY              /DO IT.
03223  0000  NEWPL6,  0
03224  1304         TAD NEWPLH       /HAVE R^2 HIGH ORDER
03225  3304         DCA NEWPLH
03226  7100         CLL              /FOR CARRY
03227  7501         MQA              /GET LOW ORDER
03230  1305         TAD NEWPLL       /ADD LOW ORDER X^2
03231  7421         MQL              /LOAD MQ FOR NORMALIZE
03232  7204         RAL CLA          /CARRY BIT OVER
03233  1304         TAD NEWPLH       /HIGH ORDER O.K.
03234  3020         DCA QR           /SAVE FOR GGRAV
03235  1020         TAD QR
03236  7411         NMI              /NORMALIZE
03237  3246         DCA NEWPL2       /STASH DIVISOR
03240  7441         SCA              /GET STEP COUNTER
03241  1306         TAD NEWPLS       /PLUS SCALE FACTOR
03242  3251         DCA NEWPL4       /STASH FOR ASR
03243  7421         MQL              /CLEAR MQ
03244  1210         TAD NEWPL1       /NOW CALC SIN/R
03245  7407         DVI
03246  0000  NEWPL2,  0
03247  7200         CLA              /GET RID OF THE REMAINDER
03250  7413         SHL              /SCALE DOWN
03251  0000  NEWPL4,  0
03252  3043         DCA QCOSTH       /STASH SIN(TH)/R
03253  1022         TAD QXPOS        /HOW ABOUT SIGN
03254  7700         SMA CLA          /SKIP IF NEED TO NEGATE
03255  5261         JMP .+4          /NOPE
03256  1043         TAD QCOSTH       /YES, NEGATE
03257  7041         CIA
```

```
03260  3043           DCA QCOSTH
03261  1246           TAD NEWPL2
03262  3270           DCA NEWPL3       /COPY DIVISOR
03263  1251           TAD NEWPL4
03264  3273           DCA NEWPL5       /COPY SCALE FACTOR
03265  7421           MQL              /CLEAR MQ
03266  1223           TAD NEWPL6       /AND COS(TH)/R
03267  7407           DVI
03270  0000  NEWPL3,   0
03271  7200           CLA
03272  7413           SHL              /AND SCALE UP
03273  0000  NEWPL5,   0
03274  3042           DCA QSINTH
03275  1023           TAD QYPOS        /WHAT ABOUT SIGN
03276  7700           SMA CLA          /SKIP IF NEEDS NEGATING
03277  5600           JMP I NEWPOL     /DONE
03300  1042           TAD QSINTH
03301  7041           CIA
03302  3042           DCA QSINTH       /NEGATE IT
03303  5600           JMP I NEWPOL

03304  0000  NEWPLH,  0
03305  0000  NEWPLL,  0
03306  0003  NEWPLS,  3
```

```
                /TAKE SQUARE ROOT OF AC.
                /MUST BE POSITIVE AND LESS THAN 200(8)
                /INTEGER NEWTON'S METHOD

03307   0000    ROOT,   0
03310   7104            CLL RAL;CLL RAL /SCALE FOR MORE PRECISION
03311   7104
03312   3337            DCA ROOTN2      /SAVE SQUARE
03313   1377            TAD (-4         /FOUR PASSES
03314   3341            DCA ROOTT       /WILL HOME IN
03315   7001            IAC             /START WITH A 1
03316   3323            DCA ROOTL1      /FOR INITIAL GUESS
03317   1323    ROOTL,  TAD ROOTL1      /COPY ITTERATION FOR COMPARE
03320   3340            DCA ROOTI       /IS LAST TRY
03321   1337            TAD ROOTN2      /NOW TO CALCULATE
03322   4472            DIVIDE          /X^2/XI
03323   0000    ROOTL1,  0
03324   7000            NOP             /DIV BY ZERO
03325   1323            TAD ROOTL1      /XI+X^2/XI
03326   7110            CLL RAR         /1/2(XI+X^2/XI)
03327   3323            DCA ROOTL1      /IS NEW VALUE
03330   2341            ISZ ROOTT       /DO IT 4 TIMES
03331   5317            JMP ROOTL
03332   1323            TAD ROOTL1      /LATEST GUESS
03333   7110            CLL RAR         /SCALE BACK DOWN
03334   7450            SNA
03335   7001            IAC             /NO ZERO'S
03336   5707            JMP I ROOT

03337   0000    ROOTN2, 0
03340   0000    ROOTI,  0
03341   0000    ROOTT,  0

                /ROUTINE TO PUT IN FLAME
                /FOR NOW DISPLAY GENERATOR DOES NOT
                /IF IN HYPERSPACE OR DEAD.

03342   0000    DFLAME, 0
03343   1046            TAD QTHR        /TO SEE IF ON
03344   7650            SNA CLA         /SKIP IF ON
03345   5742            JMP I DFLAME
03346   1376            TAD (FLAMEX
03347   3035            DCA QSHIP       /FOR CALPNT
03350   4477            RANDOM          /RANDOM LENGTH FLAME
03351   0375            AND (16
03352   7001            IAC;IAC         /ALWAYS DISP ONE
03353   7001
03354   3036            DCA QSHIPN      /LENGTH
03355   4502            DRAW    /PUT IN BUFFER
03356   5742            JMP I DFLAME

03375   0016
03376   1005
03377   7774
        3400            PAGE
```

```
                /ROUTINE TO DISPLAY THE SUN

03400   0000    SUN,    0
03401   2251            ISZ SUNCNT      /COUNTER FOR WHERE WE ARE
03402   7000            NOP             /IN THE DISPLAY
03403   7621            CLA MQL         /CLEAR MQ
03404   1251            TAD SUNCNT
03405   7413            SHL
03406   0004             4              /MAX=32
03407   7415            ASR             /PRESERVE SIGN
03410   0004             4
03411   3251            DCA SUNCNT      /PRESERV FOR NEXT TIME
03412   1251            TAD SUNCNT      /PICK UP
03413   0377            AND (7770
03414   3252            DCA SUNTMP
03415   4477            RANDOM
03416   0376            AND (7
03417   1252            TAD SUNTMP
03420   7500            SMA             /NEED NEGATIVE NUMBER
03421   7041            CIA             /MAKE NEGATIVE
03422   7104            RAL CLL         /PAIRS
03423   3226            DCA .+3         /STORE -#PNTS
03424   1375            TAD (SUNPT1-1   /ADDRESS OF PAIRS
03425   4473            DISPLAY
03426   0000             0              /-#POINTS
03427   1226            TAD .-1         /NOW FOR ALLONG X AXIS
03430   1374            TAD (220        /COUNTER LENGTH
03431   7041            CIA             /MAKE NEGATIVE
03432   3237            DCA SUNL2       /SET UP OTHER HALF
03433   7344            STA CLL RAL     /-2
03434   3253            DCA SUNHLF      /HALVES

03435   1373    SUND2,  TAD (SUNPT2-1   /START FOR OTHER AXIS
03436   4473            DISPLAY
03437   0000    SUNL2,   0
03440   5600            JMP I SUN

03441   7300    SUNL1,  CLA CLL
03442   1375            TAD (SUNPT1-1   /DISPLAY ALL
03443   4473            DISPLAY
03444   7600             -200
03445   1373            TAD (SUNPT2-1
03446   4473            DISPLAY
03447   7600             -200
03450   5600            JMP I SUN

03451   0000    SUNCNT, 0
03452   0000    SUNTMP, 0
03453   7777    SUNHLF, -1

03454   0000    POLARS, 0               /DISPLAY ONLY POLARIS
03455   7200            CLA
03456   4477            RANDOM          /GET RANDOM NUMBER
03457   0372            AND (37         /31 POINTS
03460   1371            TAD (7740       /MAKE NEG
```

```
03461   3264            DCA .+3
03462   1370            TAD (BIGSUN-1
03463   4473            DISPLAY
03464   7700            BIGSUN-ESUN
03465   5654            JMP I POLARS


03570   0777
03571   7740
03572   0037
03573   1377
03574   0220
03575   1177
03576   0007
03577   7770
        3600            PAGE
```

```
                /FIRE A MISSEL
                /BY PUTTING ANOTHER ONE IN MISTBL(POINTED TO BY MISPNT.
                /ALSO RESETS ARMED.

03600  0000  FIRONE, 0
03601  1032          TAD HYPERS
03602  7640          SZA CLA
03603  5600          JMP I FIRONE     /NOT IF IN HYPERSPACE
03604  1021          TAD ALIVE
03605  7650          SNA CLA
03606  5600          JMP I FIRONE     /OR IF DEAD
03607  1270          TAD ARMDLY       /DELAY FOR FIRING
03610  3034          DCA ARMED        /RESET FOR PROPPER DELAY
03611  1033          TAD MISCNT       /CHECK MISSLE COUNT THIS SHIP
03612  7650          SNA CLA          /SKIP IF ANY LEFT
03613  5600          JMP I FIRONE     /NO MISSELS LEFT
03614  2033          ISZ MISCNT       /UPDATE NUMBER
03615  7000          NOP              /MIGHT SKIP
03616  7421          MQL              /CLEAR MQ
03617  1270          TAD ARMDLY       /WILL ALLOW MAX OF 8 MISSELS
03620  7413          SHL              /PER SKIP
03621  0002           2               /BY *10(8)
03622  3466          DCA I MISPNT     /ALIVE FOR NEXT MISSLE
03623  2066          ISZ MISPNT
03624  1026          TAD QPH
03625  4475          SIN              /GET SIN(PHI)
03626  3242          DCA FSINPH
03627  1026          TAD QPH
03630  4474          COS              /AND COS(PHI)
03631  3234          DCA FCOSPH
03632  1377          TAD (300                 /TO START IT
03633  4471          MULT
03634  0000  FCOSPH,  0               /AT X POSITION
03635  1022          TAD QXPOS        /START
03636  3466          DCA I MISPNT     /STASH
03637  2066          ISZ MISPNT
03640  1377          TAD (300
03641  4471          MULT             /MULTIPLY
03642  0000  FSINPH,  0               /SIN(PH)=Y COORD
03643  1023          TAD QYPOS
03644  3466          DCA I MISPNT     /STASH
03645  2066          ISZ MISPNT       /POINT TO VELOCITIES
               /AND CALCULATE STARTING VELOCITY
03646  1064          TAD QTHROC       /GET MUSSEL VELOCITY
03647  3252          DCA .+3          /FOR MULTIPLY
03650  1234          TAD FCOSPH
03651  4471          MULT
03652  1000           1000
03653  1024          TAD QVX          /AND CALC STARTING Y VEL
03654  3466          DCA I MISPNT     /STASH QVX
03655  2066          ISZ MISPNT
03656  1064          TAD QTHROC
03657  3262          DCA .+3
03660  1242          TAD FSINPH
03661  4471          MULT
```

```
03662  1000            1000
03663  1025            TAD QVY
03664  3466            DCA I MISPNT     /STASH Y VEL
03665  2066            ISZ MISPNT
03666  2051            ISZ NUMMIS       /COUNT THE NUMBER OF LIVE MISS.
03667  5600            JMP I FIRONE

03670  7760  ARMDLY,   -20              /TIME DELAY BETWEEN FIREINGS


                 /GO INTO HYPERSPACE
03671  0000  HYPER,    0
03672  7240            STA
03673  3032            DCA HYPERS
03674  4477            RANDOM           /COME OUT AT RANDOM POSITION
03675  3022            DCA QXPOS
03676  4477            RANDOM
03677  3023            DCA QYPOS
03700  5671            JMP I HYPER

03777  0300
       4000            PAGE
```

```
04000  0000  MISTBL, ZBLOCK 22^5      /TABLE OF MISSELS
                     /ORDER OF DATA IS

                     /ALIVE
                     /XPOS
                     /YPOS    5 ENTRIES PER MIS.
                     /VX
                     /VY

              /THERE ARE NUMMIS OF THEM

       4200           PAGE
```

```
                /SUBROUTINE TO UPDATE MISSELS

04200  0000  MISSLS, 0
04201  1051          TAD NUMMIS        /GET NUMBER
04202  7450          SNA               /SKIP IF THERE ARE ANY
04203  5600          JMP I MISSLS      /NONE
04204  7041          CIA               /NEGATE FOR COUTING
04205  3233          DCA MISSCN        /-# TO DO
04206  1377          TAD (-100
04207  3776'         DCA STOVER        /STILL SOME STUFF
04210  3052          DCA NNUMMIS       /START WITH 0 LEFT (UPDATED BY PUTMIS)
04211  3046          DCA QTHR          /MEANINGLESS
04212  3047          DCA QTHA          /MEANINGLESS
04213  1375          TAD (MISTBL
04214  3234          DCA MISSIN        /POINTER INTO TABLE
04215  1234          TAD MISSIN
04216  3066          DCA MISPNT        /AND POINTER OUT
04217  4274  MISSL1, JMS GETMIS        /GET A MISSLE
04220  4503          NXTPOS            /CALC NEW POSITION

                /CHECK FOR HIT
04221  4774'         JMS COLID1        /COLLISION SHIP1
04222  4773'         JMS BANG          /EXPLOSION
04223  4772'         JMS COLID2        /COLLISION SHIP2
04224  4773'         JMS BANG          /EXPLOSION

04225  4237          JMS MISSUB        /LOAD THE DISPLAY BUFFER
04226  2233          ISZ MISSCNT       /MORE?
04227  5217          JMP MISSL1        /YEP
04230  1052          TAD NNUMMIS
04231  3051          DCA NUMMIS
04232  5600          JMP I MISSLS      /NO: DONE

04233  0000  MISSCN, 0
04234  0000  MISSIN, 0
04235  0000  MISST1, 0
04236  0000  MISST2, 0

                /SUBROUTINE TO LOAD UP DISPLAY BUFFER

04237  0000  MISSUB, 0
04240  1022          TAD QXPOS         /LOAD UP DISPLAY BUFFER
04241  7415          ASR               /SHIFT FOR GOOD POS
04242  0002           2
04243  6211          CDF 0
04244  3235          DCA MISST1        /SO CAN MAKE 2 COPYS
04245  1235          TAD MISST1
04246  3445          DCA I DBUFP       /LOAD X
04247  2045          ISZ DBUFP
04250  1023          TAD QYPOS
04251  7415          ASR
04252  0002           2
04253  3236          DCA MISST2        /SO CAN MAKE 2 COPYS
04254  1236          TAD MISST2
04255  3445          DCA I DBUFP       /LOAD Y
```

```
04256  2045          ISZ DBUFP
04257  1235          TAD MISST1      /ANOTHER COPY
04260  3445          DCA I DBUFP
04261  2045          ISZ DBUFP
04262  1236          TAD MISST2
04263  3445          DCA I DBUFP
04264  2045          ISZ DBUFP
04265  6201          CDF 0           /BACK TO THIS FIELD
04266  1021          TAD ALIVE
04267  7650          SNA CLA
04270  5273          JMP .+3
04271  2021          ISZ ALIVE       /CHECK IF TIME HAS RUN OUT
04272  4307          JMS PUTMIS      /NO-STILL ALIVE
04273  5637          JMP I MISSUB


               /GET SOME MISSEL DATA

04274  0000  GETMIS, 0
04275  1371          TAD (ALIVE-1
04276  3010          DCA QXR1
04277  1370          TAD (-5
04300  3056          DCA QCNT1
04301  1634          TAD I MISSIN
04302  3410          DCA I QXR1
04303  2234          ISZ MISSIN
04304  2056          ISZ QCNT1
04305  5301          JMP .-4
04306  5674          JMP I GETMIS

               /ROUTINE TO COPY MISSEL DATA BACK.

04307  0000  PUTMIS, 0
04310  2052          ISZ NNUMMIS     /COUNT THE MISSEL
04311  1371          TAD (ALIVE-1
04312  3010          DCA QXR1
04313  1370          TAD (-5
04314  3056          DCA QCNT1
04315  1410          TAD I QXR1
04316  3466          DCA I MISPNT
04317  2066          ISZ MISPNT
04320  2056          ISZ QCNT1
04321  5315          JMP .-4
04322  5707          JMP I PUTMIS

               /SUBROUTINE TO CALC NEXT POSSITION IN SHIP BREAKUP

04323  0000  SCATTE, 0
04324  1044          TAD BREAKU      /MAKE SURE SOME LEFT
04325  7450          SNA             /SKIP IF DONE
04326  5723          JMP I SCATTE    /NONE LEFT
04327  3233          DCA MISSCN      /COUNT THEM
04330  3052          DCA NNUMMIS     /CLEAR # LEFT
04331  3046          DCA QTHR        /THRUST IS OFF
04332  3047          DCA QTHA        /NO ANGLES OF COURSE
```

```
04333  1367          TAD (SCATBL     /TABLE OF PIECES
04334  3234          DCA MISSIN      /STORE IN POINTER
04335  1066          TAD MISPNT      /SAVE MISSLE POINTER
04336  3354          DCA SCATTMP
04337  1367          TAD (SCATBL     /INIT OUT POINTER
04340  3066          DCA MISPNT      /TO POINT TO PIECES
04341  4274          JMS GETMIS      /PUT ONE IN PAGE ZERO
04342  4503          NXTPOS          /UPDATE POSITION
04343  4237          JMS MISSUB      /DO DISPLAY BUFFER STUFF
04344  2233          ISZ MISSCNT     /DONE?
04345  5341          JMP .-4         /NOT YET
04346  1354          TAD SCATTMP     /YEP. RESTORE MISPNT
04347  3066          DCA MISPNT
04350  1052          TAD NNUMMIS     /NUMBER OF PIECES LEFT
04351  7041          CIA             /STORE NEGATIVE
04352  3044          DCA BREAKUP     /IN FLAG WORD
04353  5723          JMP I SCATTER

04354  0000  SCATTM, 0               /SAVE MISPNT

04367  4720
04370  7773
04371  0020
04372  4454
04373  4505
04374  4423
04375  4000
04376  5507
04377  7700
       4400          PAGE
```

```
                /ROUTINES TO CHECK FOR COLLISIONS.
                /COLIDE - CHECKS FOR COLLSION WITH SUN.
                /COLID1 - CHECKS FOR SHIP1
                /COLID2 - CHECKS FOR SHIP2
                /NOTE THAT COLID1 AND COLID2 ALSO CHECK FOR COLLISION
                /WITH SUN, BUT DO NOT TAKE EXPLODE EXIT.
                /THIS IS SO MISSELS MAY BE ROMOVED WITHOUT EXPLOSION.
                /THE ROUTINES DEADIFY THE APPROPRIATE JOBY.
                /CALL:  JMS COLIDE
                /        HIT SOMETHING
                /        NORMAL EXIT

04400   0000    COLIDE, 0
04401   1022            TAD QXPOS       /CHECK X
04402   4214            JMS COLIDS      /FOR <128
04403   7410            SKP             /A POSSIBILITY
04404   5210            JMP COLLD4      /O.K.
04405   1023            TAD QYPOS
04406   4214            JMS COLIDS
04407   5212            JMP COLLD1
04410   2200    COLLD4, ISZ COLIDE
04411   5600            JMP I COLIDE    /ALL OK
04412   3021    COLLD1, DCA ALIVE       /KILL IT
04413   5600            JMP I COLIDE    /AND TAKE FIRST EXIT


                /SUBROUTINE TO CHECK ABSOLUTE VALUE
                /OF AC<128

04414   0000    COLIDS, 0
04415   7510            SPA
04416   7041            CIA
04417   0377            AND (7600
04420   7640            SZA CLA
04421   2214            ISZ COLIDS
04422   5614            JMP I COLIDS

                /CHECK FOR COLLISION WITH SHIP1 AND SUN

04423   0000    COLID1, 0
04424   4200            JMS COLIDE      /CHECK SUN FIRST
04425   5623            JMP I COLID1
04426   1776            TAD I (SHIP1+ALIVE-QR
04427   7650            SNA CLA         /SKIP IF ALIVE
04430   5247            JMP COLLD5      /NO
04431   1775            TAD I (SHIP1+HYPERS-QR
04432   7640            SZA CLA         /SKIP IF NOT IN HYPERSPACE
04433   5247            JMP COLLD5      /IS IN HYPER.
04434   1022            TAD QXPOS
04435   7041            CIA
04436   1774            TAD I (SHIP1X
04437   4214            JMS COLIDS
04440   7410            SKP
04441   5247            JMP COLLD5
04442   1023            TAD QYPOS
```

```
04443  7041           CIA
04444  1773           TAD I (SHIP1Y
04445  4214           JMS COLIDS
04446  5251           JMP COLLD2
04447  2223  COLLD5,  ISZ COLID1       /NO COLLISION
04450  5623           JMP I COLID1
04451  3021  COLLD2,  DCA ALIVE        /KILL CURRENT MISSEL ETC.
04452  3776           DCA I (SHIP1+ALIVE-QR /AND SHIP1
04453  5623           JMP I COLID1

               /COLLISION WITH SHIP2

04454  0000  COLID2,  0
04455  4200           JMS COLIDE       /CHECK SUN
04456  5654           JMP I COLID2
04457  1772           TAD I (SHIP2+ALIVE-QR
04460  7650           SNA CLA          /SKIP IF ALIVE
04461  5300           JMP COLLD6
04462  1771           TAD I (SHIP2+HYPERS-QR
04463  7640           SZA CLA          /SKIP IF NOT IN HYPERSPACE
04464  5300           JMP COLLD6       /IS SO IGNORE
04465  1022           TAD QXPOS
04466  7041           CIA
04467  1770           TAD I (SHIP2X
04470  4214           JMS COLIDS
04471  7410           SKP
04472  5300           JMP COLLD6
04473  1023           TAD QYPOS
04474  7041           CIA
04475  1767           TAD I (SHIP2Y
04476  4214           JMS COLIDS
04477  5302           JMP COLLD3
04500  2254  COLLD6,  ISZ COLID2
04501  5654           JMP I COLID2
04502  3021  COLLD3,  DCA ALIVE
04503  3772           DCA I (SHIP2+ALIVE-QR
04504  5654           JMP I COLID2

               /ROUTINE TO SET UP PIECES OF SHIP AFTER
               /A COLLISION.

04505  0000  BANG,    0
04506  1366           TAD (BRKTBL-1
04507  3010           DCA QXR1         /POINT TO PIECES TABLE
04510  1365           TAD (SCATBL-1    /AND DESTINATION TABLE
04511  3011           DCA QXR2         /FOR INTIAL CONDITIONS
04512  1364           TAD (-20         /8 PIECES FOR NOW
04513  3056           DCA QCNT1        /TO PUT IN
04514  1410  BANGL1,  TAD I QXR1       /PICK UP LIFETIME
04515  3411           DCA I QXR2       /PUT IN TABLE
04516  1410           TAD I QXR1       /X-POSITION
04517  1022           TAD QXPOS        /MOVE TO WHERE SHIP IS
04520  3411           DCA I QXR2       /PUT AWAY
04521  1410           TAD I QXR1       /AND Y-POSITION
04522  1023           TAD QYPOS        /MOVE TO WHERE IT SHOULD BE
```

```
04523  3411          DCA I QXR2      /STASH
04524  1410          TAD I QXR1      /PICK UP A VELOCITY COMP
04525  1024          TAD QVX         /AND ADD INTIAL VELOCITY
04526  3411          DCA I QXR2      /STASH
04527  1410          TAD I QXR1      /AND Y-VELOCITY
04530  1025          TAD QVY
04531  3411          DCA I QXR2      /STASH
04532  2056          ISZ QCNT1       /DONE?
04533  5314          JMP BANGL1      /NOT YET
04534  1364          TAD (-20        /INITIALIZE BREAKUP
04535  3044          DCA BREAKUP     /ALSO IS # ENTRIES
04536  5705          JMP I BANG      /AND RETURN

04564  7760
04565  4717
04566  4577
04567  1375
04570  1374
04571  1404
04572  1373
04573  1354
04574  1353
04575  1363
04576  1352
04577  7600
       4600          PAGE
```

```
04600  7740  BRKTBL, -40;0;0;0;0
04601  0000
04602  0000
04603  0000
04604  0000
04605  7740          -40;50;0;20;0
04606  0050
04607  0000
04610  0020
04611  0000
04612  7740          -40;0;50;0;20
04613  0000
04614  0050
04615  0000
04616  0020
04617  7744          -34;20;20;20;20
04620  0020
04621  0020
04622  0020
04623  0020
04624  7744          -34;-20;-20;-20;-20
04625  7760
04626  7760
04627  7760
04630  7760
04631  7750          -30;20;-20;-20;0
04632  0020
04633  7760
04634  7760
04635  0000
04636  7750          -30;-20;20;0;-20
04637  7760
04640  0020
04641  0000
04642  7760
04643  7750          -30;0;0;40;40
04644  0000
04645  0000
04646  0040
04647  0040
04650  7754          -24;0;0;0;20
04651  0000
04652  0000
04653  0000
04654  0020
04655  7754          -24;0;0;20;0
04656  0000
04657  0000
04660  0020
04661  0000
04662  7754          -24;0;0;0;-20
04663  0000
04664  0000
04665  0000
04666  7760
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04667   7754            -24;0;0;-20;0
04670   0000
04671   0000
04672   7760
04673   0000
04674   7760            -20;20;0;10;10
04675   0020
04676   0000
04677   0010
04700   0010
04701   7760            -20;0;20;10;-10
04702   0000
04703   0020
04704   0010
04705   7770
04706   7760            -20;-20;0;-10;10
04707   7760
04710   0000
04711   7770
04712   0010
04713   7760            -20;0;-20;-10;-10
04714   0000
04715   7760
04716   7770
04717   7770

04720   0000  SCATBL, ZBLOCK 21^5

        5200            PAGE
```

```
05200  6002  SPCWAR, IOF              /RE-INITIALIZE ALL
05201  1377          TAD (SHIP1-1
05202  4500          ONDECK           /GET SHIP1 DATA
05203  4223          JMS STARTU
05204  1377          TAD (SHIP1-1
05205  4501          OFDECK           /COPY OUT
05206  1376          TAD (SHIP2-1
05207  4500          ONDECK           /GET SHIP2 INFO
05210  4223          JMS STARTU       /INITIALIZE
05211  1375          TAD (-2500
05212  3022          DCA QXPOS        /START #2 ON OTHER SIDE
05213  1376          TAD (SHIP2-1
05214  4501          OFDECK           /COPY OUT
05215  1374          TAD (MISTBL
05216  3066          DCA MISPNT       /INITIALIZE MISSELS
05217  3051          DCA NUMMIS       /NONE TO START
05220  4773'         (JMS STCLK)      /START CLOCK UP
05221  6001          ION
05222  5772'         JMP WAR-2


               /INITIALIZE PARAMETERS

05223  0000  STARTU, 0
05224  3024          DCA QVX          /START WITH NO VELOCITY
05225  3025          DCA QVY          /IN EITHER DIRECTION
05226  1371          TAD (2500        /AT THIS X
05227  3022          DCA QXPOS        /ABOUT 2/3 OUT
05230  4477          RANDOM           /AND RANDOM Y
05231  3023          DCA QYPOS        /Y POSITION RANDOM
05232  3027          DCA QPHDOT       /NO ROTATION
05233  4477          RANDOM           /AND RANDOM ANGLE
05234  0370          AND (277         /MASK FOR GOOD ANGLE
05235  3026          DCA QPH
05236  7001          IAC
05237  3021          DCA ALIVE        /MAKE IT ALIVE
05240  3031          DCA SHIELD       /SHIELDS NOT ON
05241  3032          DCA HYPERS       /NOT IN HYPERSPACE.
05242  3044          DCA BREAKU       /NOT BREAKING UP
05243  1053          TAD MAXMIS       /# MISSELS/SHIP
05244  3033          DCA MISCNT       /ALLOWED
05245  3034          DCA ARMED        /START OUT ARMED
05246  4767'         JMS SETGRV       /CALC GRAVITY TABLE
05247  5623          JMP I STARTUP

05367  3062
05370  0277
05371  2500
05372  5400
05373  6042
05374  4000
05375  5300
05376  1371
05377  1350
```

5400 PAGE

```
                /THIS IS THE MAJOR CONTROL

05400   7240            STA
05401   3777'           DCA SUNHLF      /LET'S NOT HAVE TROUBLE WITH THIS
05402   1376   WAR,     TAD (DISBUF+2   /FOR NOW INTIALIZE
05403   3045            DCA DBUFP       /DISPLAY BUFFER POINTER
05404   6211            CDF 1
05405   3775            DCA I (DISBUF
05406   3774            DCA I (DISBUF+1
05407   6201            CDF 0
05410   1373            TAD (SHIP1-1
05411   4500            ONDECK          /START OUT WITH SHIP1
05412   1021            TAD ALIVE       /NOW TO SEE IF HE EXISTS
05413   7650            SNA CLA         /SKIP IF ALIVE
05414   5231            JMP WARS2       /NOPE:GO TO SHIP2
05415   1372            TAD (-100
05416   3307            DCA STOVER      /SOMEONE STILL ALIVE
05417   7604            LAS             /GET SWITCHES
05420   4771'           JMS WARSUB      /DO THE CALCS
05421   1032            TAD HYPERS
05422   7640            SZA CLA         /SKIP IF NOT IN HYPERSPACE
05423   5226            JMP WAR1E       /IGNORE CHECKING
05424   4770'           JMS COLIDE      /CHECK FOR COLLISION WITH SUN
05425   4767'           JMS BANG        /START EXPLOSION
05426   1373   WAR1E,   TAD (SHIP1-1
05427   4501            OFDECK
05430   4505            FLAME           /DISPLAY FLAME

                /NOW FOR SHIP2

05431   1366   WARS2,   TAD (SHIP2-1
05432   4500            ONDECK          /NOW DO SHIP 2
05433   1021            TAD ALIVE       /NOW TO SEE IF HE EXISTS
05434   7650            SNA CLA         /SKIP IF ALIVE
05435   5256            JMP WARS3       /NOPE:GO TO SHIP2
05436   1372            TAD (-100
05437   3307            DCA STOVER      /SOMEONE STILL ALIVE
05440   7604            LAS             /GET SWITCHES
05441   7417            LSR;7           /OVER FOR WARSUB
05442   0007
05443   4771'           JMS WARSUB      /DO THE CALCULATIONS
05444   1032            TAD HYPERS
05445   7640            SZA CLA         /SKIP IF NOT IN HYPERSPACE
05446   5253            JMP WAR2E       /NO MORE CHECKING
05447   4770'           JMS COLIDE      /COLLISION WITH SUN FIRST
05450   7410            SKP
05451   4765'           JMS COLID1      /CHECK COLLISIONS
05452   4767'           JMS BANG        /START THE EXPLOSION
05453   1366   WAR2E,   TAD (SHIP2-1
05454   4501            OFDECK
05455   4505            FLAME
```

```
                /NOW FOR THE MISSLES

05456   6002    WARS3,  IOF
05457   4764'           JMS MISSLS      /INTERRUPTS CAN BOMB HERE
05460   6001            ION

                /AND ANY BREAKUP

05461   1044            TAD BREAKUP
05462   7640            SZA CLA         /SKIP IF ANY
05463   4763'           JMS SCATTER     /DO IT

                /NOW TO DISPLAY IT

05464   1045    WARDIS, TAD DBUFP
05465   7041            CIA
05466   1375            TAD (DISBUF
05467   6002            IOF             /NO INTS IN LINC MODE
05470   3273            DCA WARDX       /FOR DISPLAY ROUTINE
05471   1362            TAD (DISBUF-1
05472   4473            DISPLAY
05473   0000    WARDX,    0
        4507            D1=DSUN
        4506            D2=DSTARS
05474   4507            DSUN            /DISPLAY THE UNIVERSE OR SUN
05475   6001            ION
05476   2307            ISZ STOVER      /DELAY FOR AUTO RESTART
05477   7410            SKP
05500   5761'           JMP SPCWAR      /START OVER
                        IFNZRO FCLOCK+KW12+AX08+DK8EA+DK8EP <
05501   1306            TAD WAIT
05502   7650            SNA CLA
05503   5301            JMP .-2
05504   3306            DCA WAIT>
05505   5202            JMP WAR

05506   0000    WAIT,   0               /-1 WHEN READY
                                        /SET BY INTERRUPT ROUTINE
05507   0000    STOVER, 0               /DELAY FOR AUTO RESTART


05561   5200
05562   3777
05563   4323
05564   4200
05565   4423
05566   1371
05567   4505
05570   4400
05571   5600
05572   7700
05573   1350
05574   4001
05575   4000
05576   4002
```

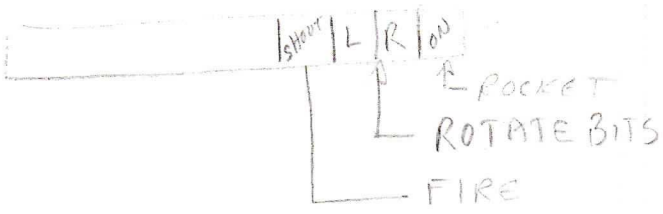
OK

```
05577  3453
       5600          PAGE
```

```
                /SUBROUTINE TO DO ALL OF THE SHIP CALCULATIONS.
                /ENTER WITH BITS SET ACCORDING TO OPTIONS

05600   0000    WARSUB, 0
05601   3777'           DCA SWITCHES
05602   1777'           TAD SWITCHES
05603   7010            RAR                 /ROCKET BIT TO LINK
05604   7630            SZL CLA             /SKIP IF NOT ON
05605   1061            TAD QTHRUST         /COPY THRUST INTO QTHR
05606   3046            DCA QTHR            /IF ROCKETS ON
05607   3032            DCA HYPERS          /TAKE OUT OF HYPERSPACE
05610   1777'           TAD SWITCHES
05611   0376            AND (6              /MASK ROT BITS
05612   7450            SNA                 /SKIP IF ANY ON
05613   5232            JMP WAR1
05614   3054            DCA QTM1            /SAVE
05615   1054            TAD QTM1
05616   1375            TAD (-6             /TO SEE IF HYPERSPACE
05617   7650            SNA CLA             /SKIP IF NOT HYPERSPACE
05620   4774'           JMS HYPER           /GO INTO HYPERSPACE
05621   1032            TAD HYPERS          /IF IN HYPERSPACE DON'T DO
05622   7640            SZA CLA             /THE CALCULATIONS
05623   5600            JMP I WARSUB
05624   1054            TAD QTM1
05625   7012            RTR                 /GET CLOCKWISE INTO LINK
05626   7200            CLA                 /GET RID OF OTHER BIT
05627   1063            TAD QRET            /RETRO CONSTANT
05630   7420            SNL                 /SKIP IF CC
05631   7041            CIA
05632   3047    WAR1,   DCA QTHA            /SET RETRO THRUST
05633   1034            TAD ARMED           /TO SEE IF ALREADY ARMED
05634   7650            SNA CLA             /SKIP IF NOT YET
05635   5240            JMP .+3             /ALREADY ARMED
05636   2034            ISZ ARMED           /UPDATE TIME DELAY
05637   5244            JMP WAR2            /NOT ARMED.
05640   1777'           TAD SWITCHES        /IS ARMED SO CHECK
05641   0373            AND (10             /FIRE BIT.
05642   7640            SZA CLA             /SKIP IF NOT FIRING
05643   4510            FIRE                /FIRE A MISSLE.
05644   4503    WAR2,   NXTPOS              /CALC NEW POSITION
05645   4504            NXTANG              /AND SHIP ANGLE
05646   4502            DRAW                /SET DISPLAY BUFFER
05647   4772'   PSAUC1, JMS SAUC            /OR NOP FOR SHIPS
05650   5600            JMP I WARSUB

05772   2200
05773   0010
05774   3671
05775   7772
05776   0006
05777   1606
        6000            PAGE
```



```
                /COME HERE FROM INTERRUPT

06000   0000    SAVAC,  0
06001   0000    SAVLK,  0

06002   3200    INTRPT, DCA SAVAC       /SAVE ACCUMULATOR
06003   7010            RAR
06004   3201            DCA SAVLK       /AND LINK
06005   6031            KSF             /KEYBOARD?
06006   5212            JMP .+4
06007   6036            KRB             /READ THE CHAR
06010   3220            DCA ICHAR       /STORE
06011   5640            JMP I OPTIONS
06012   6041            TSF             /TELEPRINTER
06013   5222            JMP CLKINT      /NO CHECK CLOCK
06014   6042            TCF             /CLEAR THAT FLAG
06015   3217            DCA TELSW       /SET NOT IN PROGRESS SWITCH
06016   5640            JMP I OPTIONS

06017   0000    TELSW,  0
06020   0000    ICHAR,  0
06021   0000    DELAY1, 0

                CLKINT,
                        IFNZRO KW12+DK8EP <
06022   6131            CLSK            /SKIP IF CLOCK
06023   5227            JMP INTEXT      /QUIT (UNDEFINED INT?)
06024   6135            CLSA            /CLEAR THE FLAGS
                        >
                        IFNZRO FCLOCK <
                        6131            /SKIP IF NOT FLAG
                        SKP
                        JMP INTEXT      /NOPE
                        6132            /RECONNECT TO INT
                        >
                        IFNZRO DK8EA <
                        ~~6133~~ 6137   /SKIP ON CLOCK
                        JMP INTEXT      /NOPE
                        ~~6131~~ 6136   /MAKE SURE INT STILL ENABLED
                        ISZ DELAY1      /WANT 30/SEC
                        JMP INTEXT      /NOPE. NEXT TIME
                        ~~CLL STA RTL~~ /~~-2~~ -3
                        DCA DELAY1      /RESET DELAY1
                        >
                        IFNZRO AX08 <
                        6321            /SKIP IF CLOCK
                        JMP INTEXT      /WHO???
                        6352            /CLEAR CLOCK
                        ISZ DELAY1
                        JMP INTEXT      /NOT YET
                        TAD CLKLIM      /RESET INTRPS
                        DCA DELAY1      /DELAY INTERVAL
                        >

06025   7240            STA             /AND SET WAITING
```

CLA CLL CMA RTL

```
06026  3777'          DCA WAIT

06027  6402  INTEXT,  6402            /LINK
06030  6412           6412
                      IFNZRO T30G <6161;NOP>
06031  7300           CLA CLL
06032  1201           TAD SAVLK        /GET LINK
06033  7104           RAL CLL
06034  1200           TAD SAVAC        /AND AC.
06035  6244           RMF              /RESTORE FIELDS
06036  6001           ION              /AND RESTOR INTERRUPTS
06037  5400           JMP I 0          /RETURN TO PROGRAM

                      /GO BACK TO SPCWAR

06040  6200  OPTION,  KBOARD
06041  5227           JMP INTEXT

                      IFNZRO KW12+DK8EP <
                      /SUBROUTINE TO START UP CLOCK
                      /MAY BE HARDWARE DEPENDENT
                      /THIS IS FOR KW12A CLOCK - PDP12
                      /OR PROGRAMABLE PDP8E CLOCK DK8EP
       6131           CLSK=6131        /SKIP IF CLOCK
       6132           CLLR=6132        /LOAD CONTROL
       6133           CLAB=6133        /AC TO BUFFER PRESET
       6134           CLEN=6134        /LOAD ENABLE
       6135           CLSA=6135        /BIT RESET FLAGS

06042  0000  STCLK,   0
06043  7300           CLA CLL          /JUST IN CASE
06044  6132  IFNZRO PDP12 <CLLR       /STOP CLOCK
06045  6134           CLEN             /CLEAR INTERRUPTS
                      >
06046  1376           TAD (-40         /ABOUT 30CPS
06047  6133           CLAB             /LOAD PRSET
06050  7300           CLA CLL
                      IFNZRO PDP12 <
06051  1375           TAD (0100        /1KC - PRESET TIME
06052  6132           CLLR             /LOAD CONTROL
06053  6135           CLSA             /CLEAR STATUS AND POSSIBLE OVERFLOW
06054  7300           CLA CLL
06055  1374           TAD (300         /INTERRUPT ON OVERFLOW
06056  6134           CLEN
06057  7300           CLA CLL
06060  1373           TAD (4100        /AND START UP CLOCK
                      >
                      IFNZRO DK8EP <
                      TAD (5300        /INTR ON CLOCK - 1KC
                      >
06061  6132           CLLR
06062  7300           CLA CLL
06063  5642           JMP I STCLK>

                      IFNZRO FCLOCK <
```

```
/DYER'S FUNNY CLOCK

STCLK,  0
        6132
        JMP I STCLK>

        IFNZRO DK8EA <
/DK8EA (LINE CLOCK)

STCLK,  0
        6131            /ENABLE INTERRUPTS
        JMP I STCLK>

        IFNZRO AX08 <
STCLK,  0
        CLA CLL
        TAD (400
        6346            /START CRYSTAL CLOCK
        TAD CLKLIM      /INITIALIZE CLOCK
        DCA DELAY1
        JMP I STCLK

CLKLIM, 7400
>

        IFZERO KW12+AX08+FCLOCK+DK8EA+DK8EP <
STCLK,  0
        JMP I STCLK>

06173   4100
06174   0300
06175   0100
06176   7740
06177   5506
        6200            PAGE
```

```
06200  4324  KBOARD, JMS GETC          /GET THE CHAR
06201  4246          JMS DISPCH        /DISPATCH ON CHAR
06202  7460          -"P;OPHLAT
06203  7007
06204  7475          -"C;OCURVE
06205  7022
06206  7472           -"F;OSTARS       /FIELD OF STARS
06207  7033
06210  7446           -"Z;OSUN         /POLARIS ONLY
06211  7042
06212  7476           -"B;OBOUNCE      /BOUNCE MODE
06213  6347
06214  7451           -"W;OWRAP        /WRAP AROUND
06215  6400
06216  7477           -"A;OANGUL       /ANGULAR MOMENT CONSERVE
06217  6410
06220  7462           -"N;ONORM        /NO ANG MOM CONS.
06221  6416
06222  7471           -"G;OGRAV        /RESET GRAVITY
06223  6461
06224  7463           -"M;OMISSL       /RESET NUMB MISSLES
06225  6502
06226  7456           -"R;ORETRO       /RESET RETRO CONSTANT
06227  6520
06230  7454           -"T;OTHRUS       /RESET THRUST CONSTANT
06231  6511
06232  7455           -"S;OSHIPS       /DISPLAY SHIPS
06233  6650
06234  7452           -"V;OVELOC       /MUSSEL VELOCITY OF MISSILES
06235  7000
06236  7453           -"U;OUFO         /DISPLAY UFO'S
06237  6626
06240  7461           -"O;OOPTION      /LIST OPTIONS
06241  6600
06242  7575           -203;7600        /^C RETURN TO MONITOR
06243  7600
06244  0000           0                /END OF LIST
06245  5777'         JMP SPCWAR        /START OVER

              /DISPATCH ON ACCUMULATOR

06246  0000  DISPCH, 0
06247  3264          DCA OTM1          /TEMP STASH
06250  1646          TAD I DISPCH      /GET COMPARISON
06251  2246          ISZ DISPCH
06252  7450          SNA               /0 MEANS DONE
06253  5646          JMP I DISPCH      /NOT IN LIST
06254  1264          TAD OTM1          /CHECK AGAINST CAHR
06255  7650          SNA CLA           /SKIP IF NO MATCH
06256  5261          JMP .+3           /MATCH
06257  2246          ISZ DISPCH        /TO NEXT CHAR
06260  5250          JMP DISPCH+2      /CONTINUE
06261  1646          TAD I DISPCH      /FOUND IT
```

```
06262  3246          DCA DISPCH      /DO DOUBLE INDIRECT
06263  5646          JMP I DISPCH

06264  0000  OTM1,    0


              /PRINT A MESSAGE

06265  0000  PRMSG,   0
06266  1665          TAD I PRMSG     /GET ADD OF MESSAGE
06267  3264          DCA OTM1        /STORE POINTER
06270  2265          ISZ PRMSG       /NORMAL EXIT
06271  1664  PRST1,   TAD I OTM1
06272  7012          RTR;RTR;RTR     /OVER FOR PRINT
06273  7012
06274  7012
06275  4302          JMS PRCHR       /PRINT LEFT HALF
06276  1664          TAD I OTM1
06277  4302          JMS PRCHR       /PRINT RIGHT HALF
06300  2264          ISZ OTM1        /NEXT WORD
06301  5271          JMP PRST1       /LOOP

06302  0000  PRCHR,   0
06303  0376          AND (77
06304  7450          SNA
06305  5665          JMP I PRMSG     /IF ZERO QUIT
06306  1375          TAD (-40        /FOR EXTEND
06307  7510          SPA             /SKIP IF NEUMERIC
06310  1374          TAD (100        /IS ALPHA
06311  1373          TAD (240        /BACK TO CORRECT
06312  4314          JMS PCH /PRINT ROUTINE
06313  5702          JMP I PRCHR


              /PRINT A CHARACTER ROUTINE

06314  0000  PCH,     0
06315  6046          TLS             /OUTPUT IT
06316  3772'         DCA TELSW       /SET TTY INPROGRESS
06317  4771'         JMS OPTIONS     /AND WAIT TILL FINISHED
06320  1772'         TAD TELSW       /KEYBOARD INTERRUPT
06321  7440          SZA
06322  5317          JMP .-3         /NOT YET
06323  5714          JMP I PCH       /DONE.

              /GET AN INPUT CHARACTER

06324  0000  GETC,    0
06325  1770'         TAD ICHAR       /FROM INTERRUPT SERVICE
06326  7440          SZA             /GOT ONE?
06327  5332          JMP .+3         /YEP
06330  4771'         JMS OPTIONS     /WAIT SOME MORE
06331  5325          JMP GETC+1
06332  3336          DCA CHAR
06333  3770'         DCA ICHAR
```

```
06334  1336           TAD CHAR
06335  5724           JMP I GETC       /AND RETURN WITH CHAR

06336  0000  CHAR,     0

06337  0000  CRLF,     0
06340  1367           TAD (215
06341  4314           JMS PCH
06342  1366           TAD (212
06343  4314           JMS PCH
06344  5737           JMP I CRLF

06345  4771' REINITIALIZE,    JMS OPTIONS
06346  5200           JMP KBOARD
```

```
                /TURN ON BOUNCE

06347  1365  OBOUNC, TAD (BOUNX
06350  3067          DCA BOUNCX
06351  1364          TAD (BOUNY
06352  3070          DCA BOUNCY
06353  4265          JMS PRMSG        /TELL HIME
06354  7437           MBOUNC
06355  4337          JMS CRLF
06356  5345          JMP REINIT

06364  2355
06365  2346
06366  0212
06367  0215
06370  6020
06371  6040
06372  6017
06373  0240
06374  0100
06375  7740
06376  0077
06377  5200
       6400          PAGE
                /ROUTINE TO DISABLE BOUNCE

06400  1377  OWRAP,  TAD (NULL
06401  3067          DCA BOUNCX
06402  1377          TAD (NULL
06403  3070          DCA BOUNCY
06404  4776'         JMS PRMSG
06405  7444           MWRAP
06406  4775'         JMS CRLF
06407  5774'         JMP REINIT
```

```
                /ROUTINE TO CONSERVE ANGULAR MOM

06410   7201    OANGUL, CLA IAC
06411   3050            DCA CONSER
06412   4776'           JMS PRMSG
06413   7454             MANGCON
06414   4775'           JMS CRLF
06415   5774'           JMP REINIT

06416   3050    ONORM,  DCA CONSER
06417   4776'           JMS PRMSG
06420   7465             MNORMAL
06421   4775'           JMS CRLF
06422   5774'           JMP REINIT

                /ROUTINE TO INPUT AN OCTAL NUMBER FROM THE KEYBOARD.
                /CALL:  JMS OCTAL
                /        RET1           /NO INPUT
                /        RET2           /AC=OCTAL NUMBER

06423   0000    OCTALX, 0
06424   3257            DCA NUMB
06425   3260            DCA INPUT
06426   4773'   OCTALL, JMS GETC
06427   4772'           JMS PCH         /AND PRINT IT
06430   1771'           TAD CHAR
06431   1370            TAD (-"8
06432   7500            SMA             /SKIP IF <"8
06433   5250            JMP NUMBEX      /EXIT
06434   1367            TAD ("8-"0      /NOW CHECK FOR OCTAL
06435   7510            SPA             /SKIP IF OK
06436   5250            JMP NUMBEX      /NO=QUIT
06437   3260            DCA INPUT       /SAVE NUMBER
06440   1257            TAD NUMB        /GET LAST NUMBER
06441   7104            CLL RAL;CLL RAL;CLL RAL
06442   7104
06443   7104
06444   1260            TAD INPUT       /STICK IN NEW NUMBER
06445   3257            DCA NUMB
06446   2260            ISZ INPUT       /MAKE SURE NON-ZERO
06447   5226            JMP OCTALL
06450   7300    NUMBEX, CLA CLL
06451   1260            TAD INPUT       /TO SEE IF ANY
06452   7640            SZA CLA
06453   2223            ISZ OCTALX      /TAKE YES RETURN
06454   4775'           JMS CRLF
06455   1257            TAD NUMB        /STICK NUMBER IN AC
06456   5623            JMP I OCTALX    /AND RETURN

06457   0000    NUMB,   0
06460   0000    INPUT,  0


06461   4776'   OGRAV,  JMS PRMSG       /TELL HIM WHAT OPTION IS
06462   7500             MGRAVY
```

```
06463  4223           JMS OCTALX       /GET NEW VALUE
06464  5774'          JMP REINIT       /NO INPUT
06465  3062           DCA QGRAV        /SET VALUE
06466  1366           TAD (KBOARD      /REINITIALIZE
06467  3765'          DCA OPTIONS
06470  4764'          JMS SETGRV       /SET UP TABLE
06471  1062           TAD QGRAV        /NOW TO SEE IF ANTI-GRAV.
06472  7700           SMA CLA          /SKIP IF YES
06473  5763'          JMP WAR-2
06474  4776'          JMS PRMSG
06475  7516            MAGRAV          /ANTI GRAVITY
06476  4775'          JMS CRLF
06477  1366           TAD (KBOARD
06500  3765'          DCA OPTIONS
06501  5763'          JMP WAR-2

06502  4776' OMISSL,  JMS PRMSG
06503  7525            MMISSLS
06504  4223           JMS OCTALX       /GET A NUMBER
06505  5774'          JMP REINIT
06506  7041           CIA              /SET MISSEL CONSTANT
06507  3053           DCA MAXMIS       /SET CONSTANT
06510  5774'          JMP REINIT       /DONE

               /ROUTINE TO READJUST THRUST

06511  4776' OTHRUS,  JMS PRMSG
06512  7537            MTHRUS
06513  4223           JMS OCTALX
06514  5774'          JMP REINIT
06515  7106           CLL RTL
06516  3061           DCA QTHRUS
06517  5774'          JMP REINIT

               /ROUTINE TO SET RETRO CONSTANT

06520  4776' ORETRO,  JMS PRMSG
06521  7552            MRETRO
06522  4223           JMS OCTALX
06523  5774'          JMP REINIT
06524  3063           DCA QRET
06525  5774'          JMP REINIT

               /ROUTINE TO PRINT LOTS OF MESSAGES

06526  0000  MMESG,   0
06527  4775'          JMS CRLF         /NEW LINE
06530  1726           TAD I MMESG      /GET START OF MESSAGE
06531  7450           SNA              /SKIP IF MORE TO COME
06532  5726           JMP I MMESG
06533  3335           DCA .+2
06534  4776'          JMS PRMSG        /PRINT IT
06535  0000            0
06536  2326           ISZ MMESG        /NEXT LINE
06537  5327           JMP MMESG+1      /MORE
```

```
                /PRINT OPTIONS

06563   5400
06564   3062
06565   6040
06566   6200
06567   0010
06570   7510
06571   6336
06572   6314
06573   6324
06574   6345
06575   6337
06576   6265
06577   1003
        6600            PAGE
06600   4777' OOPTIO,   JMS MMESG
06601   7222             MOPTA
06602   7247             MOPTB
06603   7274             MOPTBA
06604   7310             MOPTC
06605   7324             MOPTD
06606   7334             MOPTE
06607   7354             MOPTF
06610   7412             MCURVE
06611   7421             MPHLAT
06612   7427             MSTARS
06613   7344             MSUN
06614   7437             MBOUNC
06615   7444             MWRAP
06616   7454             MANGCO
06617   7465             MNORMA
06620   7525             MMISSL
06621   7537             MTHRUS
06622   7552             MRETRO
06623   7200             MVELOX
06624   0000             0
06625   5776'           JMP REINIT
```

```
                /DISPLAY SAUCERS (UFO'S)

06626   4775'  OUFO,   JMS PRMSG
06627   7374            MUFO
06630   4774'           JMS CRLF
06631   1373            TAD (JMS I PSAUCP
06632   3772'           DCA PSAUC1
06633   1371            TAD (NOP
06634   3770'           DCA PSAUC2
06635   1367            TAD (SAUC1
06636   3766            DCA I (SHIP1+QSHIP-QR
06637   1365            TAD (SAUC1E-SAUC1
06640   3764            DCA I (SHIP1+QSHIPN-QR
06641   1363            TAD (SAUC2
06642   3762            DCA I (SHIP2+QSHIP-QR
06643   1361            TAD (SAUC2E-SAUC2
06644   3760            DCA I (SHIP2+QSHIPN-QR
06645   1357  OUFOR,    TAD (KBOARD
06646   3756'           DCA OPTIONS
06647   5755'           JMP WAR-2

                /DISPLAY SHIPS

06650   4775'  OSHIPS,  JMS PRMSG
06651   7403            MSHIPS
06652   4774'           JMS CRLF
06653   1270            TAD OSHIPJ
06654   3770'           DCA PSAUC2
06655   1371            TAD (NOP
06656   3772'           DCA PSAUC1
06657   1354            TAD (SHIP1C
06660   3766            DCA I (SHIP1+QSHIP-QR
06661   1353            TAD (SHIP1E-SHIP1C
06662   3764            DCA I (SHIP1+QSHIPN-QR
06663   1352            TAD (SHIP2C
06664   3762            DCA I (SHIP2+QSHIP-QR
06665   1351            TAD (SHIP2E-SHIP2C
06666   3760            DCA I (SHIP2+QSHIPN-QR
06667   5245            JMP OUFOR

06670   5323  OSHIPJ,  PSAUC2+3&177+5200


06751   0050
06752   1201
06753   0060
06754   1025
06755   5400
06756   6040
06757   6200
06760   1410
06761   0006
06762   1407
06763   1315
```

```
06764  1367
06765  0016
06766  1366
06767  1163
06770  2120
06771  7000
06772  5647
06773  4465
06774  6337
06775  6265
06776  6345
06777  6526
       7000          PAGE
             /RESET MUSSEL VELOCITY OF ROCKETS

07000  4777' OVELOC, JMS PRMSG
07001  7200           MVELOX
07002  4776           JMS I (OCTALX
07003  5775'          JMP REINIT
07004  7110           CLL RAR
07005  3064           DCA QTHROC       /RESET MUSSLE VELOCITY
07006  5775'          JMP REINIT

             /SELECT FLAT OR CURVED SPACE

07007  4777' OPHLAT, JMS PRMSG
07010  7421           MPHLAT
07011  4774'          JMS CRLF
07012  7200           CLA
07013  1373           TAD (3777
07014  3041           DCA QTIME        /NO TIME CURVE ON OUTLINE
07015  1372           TAD (SC
07016  3771'          DCA NEWP07+1
07017  1372           TAD (SC
07020  3770'          DCA NEWP07+11
07021  5775'          JMP REINIT

07022  4777' OCURVE, JMS PRMSG
07023  7412           MCURVE
07024  4774'          JMS CRLF
07025  7200           CLA
07026  1367           TAD (SC1
07027  3771'          DCA NEWP07+1
07030  1366           TAD (SC2
07031  3770'          DCA NEWP07+11
07032  5775'          JMP REINIT

             /DISPLAY OPTIONAL SUN OR UNIVERSE

07033  4777' OSTARS, JMS PRMSG
07034  7427           MSTARS
07035  4774'          JMS CRLF
07036  7200           CLA
07037  1365           TAD (D2
07040  3764'          DCA WARDX+1
```

```
07041   5775'           JMP REINIT

07042   4777' OSUN,     JMS PRMSG
07043   7344            MSUN
07044   4774'           JMS CRLF
07045   7200            CLA
07046   1363            TAD (D1
07047   3764'           DCA WARDX+1
07050   5775'           JMP REINIT

07163   4507
07164   5474
07165   4506
07166   4776
07167   4777
07170   2652
07171   2642
07172   4315
07173   3777
07174   6337
07175   6345
07176   6423
07177   6265
        7200'           PAGE
```

```
07200  2605  MVELOX, TEXT \VELOCITY INITIAL OF MISSLES(2000):\
07201  1417
07202  0311
07203  2431
07204  4011
07205  1611
07206  2411
07207  0114
07210  4017
07211  0640
07212  1511
07213  2323
07214  1405
07215  2350
07216  6260
07217  6060
07220  5172
07221  0000
07222  1720  MOPTA,  TEXT \OPTIONS ARE DESIGNATED BY FIRST CHARACTER\
07223  2411
07224  1716
07225  2340
07226  0122
07227  0540
07230  0405
07231  2311
07232  0716
07233  0124
07234  0504
07235  4002
07236  3140
07237  0611
07240  2223
07241  2440
07242  0310
07243  0122
07244  0103
07245  2405
07246  2200
07247  2410  MOPTB,  TEXT \THE NUMBER IN PARENS ARE "NORMAL" VALUES\
07250  0540
07251  1625
07252  1502
07253  0522
07254  4011
07255  1640
07256  2001
07257  2205
07260  1623
07261  4001
07262  2205
07263  4042
07264  1617
07265  2215
07266  0114
```

```
07267  4240
07270  2601
07271  1425
07272  0523
07273  0000
07274  1116  MOPTBA, TEXT \INPUT NUMBERS ARE OCTAL\
07275  2025
07276  2440
07277  1625
07300  1502
07301  0522
07302  2340
07303  0122
07304  0540
07305  1703
07306  2401
07307  1400
07310  0126  MOPTC,  TEXT \AVAILABLE OPTIONS ARE:\
07311  0111
07312  1401
07313  0214
07314  0540
07315  1720
07316  2411
07317  1716
07320  2340
07321  0122
07322  0572
07323  0000
07324  2540  MOPTD,  TEXT \U DISPLAY UFO'S\
07325  0411
07326  2320
07327  1401
07330  3140
07331  2506
07332  1747
07333  2300
07334  2340  MOPTE,  TEXT \S DISPLAY SHIPS\
07335  0411
07336  2320
07337  1401
07340  3140
07341  2310
07342  1120
07343  2300
07344  3240  MSUN,   TEXT 'Z POLARIS ONLY'
07345  2017
07346  1401
07347  2211
07350  2340
07351  1716
07352  1431
07353  0000
07354  0740  MOPTF,  TEXT \G RESET GRAVITY CONSTANT(1000)\
07355  2205
```

```
07356  2305
07357  2440
07360  0722
07361  0126
07362  1124
07363  3140
07364  0317
07365  1623
07366  2401
07367  1624
07370  5061
07371  6060
07372  6051
07373  0000
07374  0411  MUFO,   TEXT \DISPLAY UFO'S\
07375  2320
07376  1401
07377  3140
07400  2506
07401  1747
07402  2300
07403  0411  MSHIPS, TEXT \DISPLAY SHIPS\
07404  2320
07405  1401
07406  3140
07407  2310
07410  1120
07411  2300
07412  0325  MCURVE, TEXT 'CURVED SPACE'
07413  2226
07414  0504
07415  4023
07416  2001
07417  0305
07420  0000
07421  2010  MPHLAT, TEXT 'PHLAT SPACE'
07422  1401
07423  2440
07424  2320
07425  0103
07426  0500
07427  0611  MSTARS,  TEXT 'FIELD OF STARS'
07430  0514
07431  0440
07432  1706
07433  4023
07434  2401
07435  2223
07436  0000
07437  0217  MBOUNC, TEXT \BOUNCE ON\
07440  2516
07441  0305
07442  4017
07443  1600
07444  2722  MWRAP,  TEXT \WRAP-AROUND ON\
```

```
07445  0120
07446  5501
07447  2217
07450  2516
07451  0440
07452  1716
07453  0000
07454  0116  MANGCO, TEXT \ANGULAR MOMENTUM\
07455  0725
07456  1401
07457  2240
07460  1517
07461  1505
07462  1624
07463  2515
07464  0000
07465  1617  MNORMA, TEXT \NON-ANGULAR MOMENTUM\
07466  1655
07467  0116
07470  0725
07471  1401
07472  2240
07473  1517
07474  1505
07475  1624
07476  2515
07477  0000
07500  2324  MGRAVY, TEXT \STRENGTH OF GRAVITY(1000).\
07501  2205
07502  1607
07503  2410
07504  4017
07505  0640
07506  0722
07507  0126
07510  1124
07511  3150
07512  6160
07513  6060
07514  5172
07515  0000
07516  0116  MAGRAV, TEXT \ANTI-GRAVITY\
07517  2411
07520  5507
07521  2201
07522  2611
07523  2431
07524  0000
07525  1501  MMISSL, TEXT \MAX NUMBER MISSLES.\
07526  3040
07527  1625
07530  1502
07531  0522
07532  4015
07533  1123
```

```
07534   2314
07535   0523
07536   7200
07537   2410   MTHRUS, TEXT \THRUST CONSTANT (2):\
07540   2225
07541   2324
07542   4003
07543   1716
07544   2324
07545   0116
07546   2440
07547   5062
07550   5172
07551   0000
07552   2205   MRETRO, TEXT \RETRO-THRUST (4):\
07553   2422
07554   1755
07555   2410
07556   2225
07557   2324
07560   4050
07561   6451
07562   7200

        7600'          PAGE
```

```
                        IFNZRO D <
          7600          XXX=.
00177     6002
          0001          FIELD D%10
          1000          *1000>

                        DECIMAL
                BIGSUN,
11000     0000          0;0
11001     0000
11002     0006          6;4; -6;-4; 0;7; 0;-7; -6;4; 6;-4
11003     0004
11004     7772
11005     7774
11006     0000
11007     0007
11010     0000
11011     7771
11012     7772
11013     0004
11014     0006
11015     7774
11016     7762          -14;0; 14;0; -7;-12; 7;12; 7;-12; -7;12
11017     0000
11020     0016
11021     0000
11022     7771
11023     7764
11024     0007
11025     0014
11026     0007
11027     7764
11030     7771
11031     0014
11032     0000          0;-21; 0;21; 19;-11; -19;11; 19;11; -19;-11
11033     7753
11034     0000
11035     0025
11036     0023
11037     7765
11040     7755
11041     0013
11042     0023
11043     0013
11044     7755
11045     7765
11046     0016          14;-25; -14;25; 28;0; -28;0; 14;25; -14;-25
11047     7747
11050     7762
11051     0031
11052     0034
11053     0000
11054     7744
11055     0000
11056     0016
```

```
11057  0031
11060  7762
11061  7747
11062  0000          0;35; 0;-35; 20;30; -20;-30; -20;30; 20;-30
11063  0043
11064  0000
11065  7735
11066  0024
11067  0036
11070  7754
11071  7742
11072  7754
11073  0036
11074  0024
11075  7742
11076  0000          0;0
11077  0000

       1100          ESUN=.
```

```
                IFNZRO 0 <
                -2;12; 0;12; 3;12; -4;11; -1;11; 1;11; 4;11; 6;11
        -6;10; -3;10; 2;10; 4;10; 8;10; -8;9; -4;9; -2;9; 0;9
        4;9; 6;9; 7;9; -8;8; -6;8; -3;8; 2;8; 6;8; 8;8; 10;8; -10;7
        8;7; 9;7; -8;6; -5;6; 0;6; 3;6; 10;6; 11;6; -11;5; -9;5
        -2;5; 5;5; 7;5; 9;5; 11;5; -7;4; 3;4; 12;4; -10;3
        -4;3; -1;3; 1;3; 7;3; 10;3; 11;3; -12;2
        -11;2; -6;2; 4;2; 12;2; 13;2
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        -5;0; 6;0; 13;0; -11;-1; -3;-1; 0;-1; 3;-1; 9;-1; 12;-1; -12;-2; -
        -8;-1; -6;-2; -1;-2; 7;-2; 11;-2; 12;-2; -9;-3; -4;-3
        4;-3; 11;-3; -11;-4; -9;-4; -7;-4; -1;-4; 2;-4; 7;-4
        10;-4; 12;-4; 11;-5; -11;-6; -9;-6
        -8;-6; -6;-6; 4;-5; 6;-6; 8;-6; 9;-6; 11;-6; -10;-7
        -8;-7; -2;-7; 1;-7
        -8;-8; -6;-8; 6;-8; 8;-8; 9;-8; -8;-9; -6;-9; -4;-9; 4;-9; 7;-9
        -6;-10; -2;-10; 0;-10; 2;-10; 4;-10; 5;-10; 7;-10; -5;-11; -3;-11;
        2;-11; 5;-11; -3;-12; -1;-12; 1;-12; 3;-12
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1200            PAGE
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11201   7522
11202   0076
11203   0154
11204   7632
11205   0037
11206   7600
11207   0372
11210   0057    47;-171;        106;85; -88;20;           -128;242
11211   7525
11212   0152
11213   0125
11214   7650
11215   0024
11216   7600
11217   0362
11220   0041    33;-194;        91;91;  -91;9;            -139;225
11221   7476
11222   0133
11223   0133
11224   7645
11225   0011
11226   7565
11227   0341
11230   0050    40;-191;        71;88;  -91;-23;          -146;216
11231   7501
11232   0107
11233   0130
11234   7645
11235   7751
11236   7556
11237   0330
                /SOME MISC.
11240   7553    -149;-213       /IN PUPPIS
11241   7453
11242   7654    -84;-168        /PROCYON
11243   7530
11244   0161    113;-46         /IN ANDROMEDA
11245   7722
11246   7765    -11;77          /ELTANIN
11247   0115

                /ORION          SIGNUS  URSIA MAJOR       SCORPIO
11250   0057    47;-188;        73;74;  -73;-20;          -153;213
11251   7504
11252   0111
11253   0112
11254   7667
11255   7754
11256   7547
11257   0325
11260   0032    26;-211;        47;85;  -102;-9;          -164;194
11261   7455
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11262   0057
11263   0125
11264   7632
11265   7767
11266   7534
11267   0302
11270   0102   66;-199;          29;74;   -88;-3;          -175;196
11271   7471
11272   0035
11273   0112
11274   7650
11275   7775
11276   7521
11277   0304
11300   0067                     55;120;                   -182;199
11301   0170
11302   7512
11303   0307

                /PLUS SOME MISCELLANEOUS
11304   7613   -117;188
11305   0274
11306   7530   -168;71           /ARCTURUS
11307   0107
11310   0006   6;6;-6;-6         /SOME SUN SPOTS
11311   0006
11312   7772
11313   7772
11314   0320   208;-105          /NECK OF CETUS
11315   7627
11316   0320   208;102           /IN AQUARIUS
11317   0146
11320   7417   -241;17           /SPICA
11321   0021

                /CASEOPEA         CANUS MAJOR      PLEIADES
11322   0076   62;-23;           -18;-253;        117;-110
11323   7751
11324   7756
11325   7403
11326   0165
11327   7622
11330   0111   73;-20;           -29;-239;        117;-108
11331   7754
11332   7743
11333   7421
11334   0165
11335   7624
11336   0111   73;-11;           -18;-228;        113;-111
11337   7765
11340   7756
11341   7434
11342   0161
11343   7621
11344   0130   88;-9;            -44;-222;        113;-108
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11355  7453
11356  7632                   -102;-239
11357  7421
11360  7663                   -77;-239
11361  7421
11362  7676                   -66;-248
11363  7410
11364  7676                   -66;-219
11365  7445
11366  7707                   -57;-222
11367  7442
                /PLUS SOME MISCELLANEOUS
11370  0006  6;-6;-6;6        /MORE SUN SPOTS
11371  7772
11372  7772
11373  0006
11374  7432  -230;159         /IN LIBRA
11375  0237
11376  7470  -200;-139         /ALPHARD
11377  7565

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11403  7777
11404  0001
11405  0000
11406  7777
11407  0000
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11412  0000
11413  7776
11414  0002
11415  0000
11416  7776
11417  0000
11420  0000  0;4; 0;-4; 4;0; -4;0
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11422  0000
11423  7774
11424  0004
11425  0000
11426  7774
11427  0000
11430  0000  0;6; 0;-6; 6;0; -6;0
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11431   0006
11432   0000
11433   7772
11434   0006
11435   0000
11436   7772
11437   0000

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11440   0222    146;-29             /IN ANDROMEDA
11441   7743
11442   0120    80;-143             /ALDEBARAN IN TAURUS
11443   7561
11444   7623    -109;100            /ALPHECCA IN CORONA BOREALIS
11445   0144
11446   0231    153;-68             /IN ARIES
11447   7674

                /LEO                SAGITARIUS GEMINI       PEGASIS
11450   7470    -200;-17;           -18;250; -55;-114;      168;102
11451   7757
11452   7756
11453   0372
11454   7711
11455   7616
11456   0250
11457   0146
11460   7442    -222;-43;           4;250;  -69;-120;       160;40
11461   7725
11462   0004
11463   0372
11464   7673
11465   7610
11466   0240
11467   0050
11470   7470    -200;-43;           15;242; -73;-128;       193;46
11471   7725
11472   0017
11473   0362
11474   7667
11475   7600
11476   0301
11477   0056
11500   0012    10;0;0;10;-10;0;0;-10   /MORE SUN
11501   0000
11502   0000
11503   0012
11504   7766
11505   0000
11506   0000
11507   7766
11510   7506    -186;-37;           40;242; -58;-125;       164;0
11511   7733
11512   0050
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11513  0362
11514  7706
11515  7603
11516  0244
11517  0000
                /BRIGHT STARS
11520  7502     -190;145          /IN LIBRA
11521  0221
11522  0013     11;105            /LYRA
11523  0151
11524  0105     69;-63            /MIRFAK IN PERSEUS
11525  7701
11526  0244     164;-63           /IN ARIES
11527  7701

                /LEO              SAGITARIUS GEMINI        PEGASIS
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11532  0063
11533  0357
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11535  7606
11536  0310
11537  0000
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11541  7671
11542  0102
11543  0344
11544  7737
11545  7613
11546  7512     -182;-85;         51;228; -58;-151
11547  7653
11550  0063
11551  0344
11552  7706
11553  7551
11554  7525     -171;-83;         62;246; -58;-137
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11556  0076
11557  0366
11560  7706
11561  7567
                /BRIGHT STARS
11562  7530     -168;-240         /IN PUPPIS
11563  7420
11564  7442     -222;137          /IN LIBRA
11565  0211
11566  7460     -208;29           /IN VIRGO
11567  0035
11570  0130     88;157            /ALTAIR
11571  0235

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11607  7567
11610  7556     -146;-77;                  -22;-154
11611  7663
11612  7752
11613  7546
11614  7737                                -33;-159
11615  7541
                /AURIGA
11616  0032     26;-88;47;-114;29;-128;4;-97
11617  7650
11620  0057
11621  7616
11622  0035
11623  7600
11624  0004
11625  7637
11626  0004     4;4;4;-4;-4;4;-4;-4       /MORE SUN
11627  0004
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11633  0004
11634  7774
11635  7774

11636  0000     0;0
11637  0000
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ARMDLY 3670
ARMED  0034
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AX08   0000
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BIGSUN 1000
BOUNCX 0067
BOUNCY 0070
BOUNX  2346
BOUNY  2355
BREAKU 0044
BRKTBL 4600
BSHIP  1323
BSHIPE 1351
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CALPT  2155
CALPTX 2156
CALPTY 2157
CALPT2 2160
CALPX  2153
CALPX1 2071
CALPX2 2110
CALPY  2154
CALPY1 2075
CALPY2 2114
CALPY3 2122
CALPY4 2161
CALPY5 2162
CHAR   6336
CLAB   6133
CLEN   6134
CLKINT 6022
CLLR   6132
CLSA   6135
CLSK   6131
COLIDE 4400
COLIDS 4414
COLID1 4423
COLID2 4454
COLLD1 4412
COLLD2 4451
COLLD3 4502
COLLD4 4410
COLLD5 4447
COLLD6 4500
COMPAR 3034
CONSER 0050
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CRLF   6337
D      0010
DBUFP  0045
DELAY1 6021
DFLAME 3342
DIS    0140
DISBUF 4000
DISPCH 6246
DISPLA 4473
DIVIDE 4472
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DK8EP  0000
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DSTARS 4506
DSUN   4507
DVI    7407
D1     4507
D2     4506
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FCOSPH 3634
FIRE   4510
FIRONE 3600
FLAME  4505
FLAMEX 1005
FSINPH 3642
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GETMIS 4274
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HYPERS 0032
ICHAR  6020
INPUT  6460
INTEXT 6027
INTRPT 6002
KBOARD 6200
KW12   0001
LINC   6141
LOOKUP 2400
LSR    7417
MAGRAV 7516
MANGCO 7454
MAXMIS 0053
MBOUNC 7437
MCURVE 7412
MGRAVY 7500
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MISPNT 0066
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MISSIN 4234
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MISST2 4236
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MOPTB  7247
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MOPTE  7334
MOPTF  7354
MPHLAT 7421
MRETRO 7552
MSHIPS 7403
MSTARS 7427
MSUN   7344
MTHRUS 7537
MUFO   7374
MULT   4471
MUY    7405
MVELOX 7200
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NEWPLS 3306
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NEWPL2 3246
NEWPL3 3270
NEWPL4 3251
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NEWPL6 3223
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NEWPO2 2625
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NEWPO6 2623
NEWPO7 2641
NEWPO8 2675
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NUMMIS 0051
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NXTPOS 4503
OANGUL 6410
OBOUNC 6347
OCTALL 6426
OCTALX 6423
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OMISSL 6502
ONDECK 4500
ONORM  6416
OOPTIO 6600
OPHLAT 7007
OPTION 6040
ORETRO 6520
OSHIPJ 6670
OSHIPS 6650
OSTARS 7033
OSUN   7042
OTHRUS 6511
OTM1   6264
OUFO   6626
OUFOR  6645
OVELOC 7000
OWRAP  6400
PCH    6314
PDP    0002
PDP12  0001
POLARS 3454
PRCHR  6302
PRMSG  6265
PRST1  6271
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PSAUC1 5647
PSAUC2 2120
PUTMIS 4307
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QBETA  0006
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QCNT2  0057
QCNT3  0060
QCOSPH 0040
QCOSTH 0043
QDISXR 0012
QGRAV  0062
QPH    0026
QPHDOT 0027
QPHR   0030
QR     0020
QRET   0063
QSHIP  0035
QSHIPN 0036
QSINPH 0037
QSINTH 0042
QTHA   0047
QTHR   0046
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QTHRUS 0061
QTIME  0041
QTM1   0054
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QXR2    0011
QXR3    0013
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RANUML  0355
RANUMT  0353
REINIT  6345
ROOT    3307
ROOTI   3340
ROOTL   3317
ROOTL1  3323
ROOTN2  3337
ROOTT   3341
SALPNL  2231
SALPN1  2237
SALPN2  2233
SALPTX  2314
SALPTY  2315
SALPX   2316
SALPY   2317
SAUC    2200
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SAUC1E  1201
SAUC2   1315
SAUC2E  1323
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SAVLK   6001
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SCA     7441
SCALE   2715
SCALE1  3000
SCALE2  3035
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SCATTE  4323
SCATTM  4354
SCL     7403
SC1     4777
SC2     4776
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SETGRV  3062
SETGRX  3077
SETGR1  3106
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SHIPSZ  0021
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SHIP1C  1025
SHIP1E  1105
SHIP1X  1353
SHIP1Y  1354
SHIP2   1372
SHIP2C  1201
SHIP2E  1251
SHIP2X  1374
SHIP2Y  1375
SHL     7413
SIN     4475
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SPCWAR  5200
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STOVER  5507
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SUND2   3435
SUNHLF  3453
SUNL1   3441
SUNL2   3437
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SUNPT2  1400
SUNTMP  3452
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T2      2031
T3      2053
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T4      2061
VC8E    0000
WAIT    5506
WAR     5402
WARDIS  5464
WARDX   5473
WARSUB  5600
WARS2   5431
WARS3   5456
WAR1    5632
WAR1E   5426
WAR2    5644
WAR2E   5453
XADDD   2320
XADDD1  2345
XADDD2  2341
XCOSIN  0325
XDISL   0272
XDISPL  0260
XDIVID  0234
XGGRAV  3050
XMULT   0202
XMULTS  0233
XMULT1  0217
XOFDEC  1616
XONDEC  1600
XRANDO  0331
XSINE   0306
XSQUAR  3061
XXX     7600
XXXXXX  0111
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