UNIVERSAL WINDOW TIMES
JULY 1976 thru DECEMBER 1977

AN HP2000C BASIC COMPUTER
PROGRAM FOR MOON TRACKING

DIVISION OF VARIAN
301 Industrial Way
San Carlos, California

The following Universal Window times are based on
the new specifications outlined in AS-49-12.   The moon
is always at a north, or positive, declination during
the European Universal Window.   The start of the window
is two hours from the setting moon time in Frankfurt,
Germany.   The end of the window is when the moon sets at
this same location.   The level of activity in any of the
windows will depend upon how reasonable the time of the
day is.   Early hours in the morning on working days will
not be too attractive to many operators.   The last hour
of the window will be the most popular time for those
stations with antennas pointing toward the horizon.

The times were calculated in two minute increments;
therefore, there can be up to a plus or minus two minute
error.

Also included are the times each month for the new
moon.   During the summer months the moon and sun appear
to be in the same place in the sky.   The sun noise can
therefore mask any moonbounce signals.   At least one day
can be lost, and perhaps more, depending upon the directiv-
ity of the antenna arrays at both ends of the path.

JULY-1976	
Day	GMT
1	1924-2123
2	1950-2149
16	0708-0909
17	0813-1014
18	0917-1116
19	1019-1217
20	1118-1319
21	1218-1417
22	1314-1514
23	1408-1606
24	1458-1657
25	1544-1742
26	1623-1822
27	1659-1855
28	1729-1925
29	1755-1953

AUGUST-1976	
Day	GMT
13	0558-0758
14	0703-0903
15	0805-1005
16	0906-1106
17	1007-1204
18	1103-1302
19	1157-1356
20	1249-1447
21	1336-1532
22	1418-1616
23	1454-1653
24	1527-1726
25	1557-1755

SEPTEMBER-1976	
Day	GMT
9	0344-0546
10	0448-0649
11	0553-0753
12	0655-0855
13	0755-0955
14	0853-1051
15	0947-1147
16	1038-1238
17	1127-1324
18	1210-1408
19	1248-1445
20	1323-1521
21	1353-1551
22	1421-1619

OCTOBER-1976	
Day	GMT
7	0238-0441
8	0343-0544
9	0444-0644
10	0546-0746
11	0644-0844
12	0740-0938
13	0833-1030
14	0921-1120
15	1004-1203
16	1044-1242
17	1119-1317
18	1150-1348
19	1220-1418
20	1246-1446

NOVEMBER-1976	
Day	GMT
3	0031-0233
4	0135-0335
5	0237-0437
6	0338-0537
7	0438-0638
8	0534-0734
9	0629-0827
10	0719-0915
11	0804-1002
12	0844-1042
13	0920-1118
14	0952-1148
15	1020-1218
16	1046-1244
29-30	2222-0022
30-1	2327-0127

DECEMBER-1976	
Day	GMT
2	0029-0229
3	0131-0331
4	0231-0429
5	0329-0527
6	0424-0621
7	0516-0714
8	0602-0800
9	0646-0842
10	0723-0921
11	0756-0952
12	0824-1022
13	0850-1048
27	2114-2314
28-29	2218-0018
29-30	2320-0120
31	0020-0220

JANUARY-1977

Day	GMT
1	0119-0319
2	0216-0414
3	0308-0508
4	0359-0557
5	0444-0642
6	0523-0721
7	0559-0757
8	0629-0827
9	0657-0855
10	0722-0920
23	1855-2055
24	2001-2201
25	2105-2305
26-27	2206-0006
27-28	2306-0106
29	0004-0202
30	0059-0257
31	0149-0347

FEBRUARY-1977

Day	GMT
1	0238-0434
2	0320-0518
3	0359-0555
4	0431-0629
5	0501-0659
6	0527-0725
20	1742-1944
21	1848-2050
22	1953-2151
23	2053-2253
24	2152-2351
25-26	2246-0045
26-27	2338-0138
28	0027-0225

MARCH-1977

Day	GMT
1	0112-0310
2	0153-0349
3	0227-0425
4	0259-0457
5	0329-0527
19	1527-1729
20	1633-1835
21	1738-1938
22	1840-2040
23	1940-2140
24	2036-2236
25	2131-2329
26-27	2220-0018
27-28	2304-0102
28-29	2346-0144
30	0023-0221
31	0057-0253

APRIL-1977

Day	GMT
1	0126-0324
2	0154-0352
16	1423-1623
17	1527-1727
18	1631-1831
19	1731-1931
20	1829-2027
21	1923-2123
22	2014-2212
23	2100-2258
24	2142-2340
25-26	2242-0018
26-27	2255-0051
27-28	2325-0122
28-29	2352-0151
30	0020-0218

MAY-1977

Day	GMT
13	1216-1416
14	1320-1520
15	1422-1622
16	1523-1723
17	1623-1821
18	1719-1917
19	1812-2010
20	1859-2057
21	1942-2140
22	2021-2219
23	2055-2253
24	2127-2325
25	2154-2352
26-27	2220-0018

JUNE-1977

Day	GMT
9	1015-1207
10	1111-1313
11	1214-1416
12	1316-1516
13	1416-1616
14	1512-1712
15	1606-1806
16	1657-1855
17	1742-1940
18	1823-2021
19	1859-2057
20	1931-2129
21	1959-2157
22	2025-2213

JULY-1977	
Day	GMT
7	0859-1059
8	1005-1205
9	1108-1308
10	1208-1406
11	1305-1505
12	1401-1559
13	1451-1651
14	1540-1738
15	1623-1821
16	1701-1859
17	1735-1933
18	1805-2003
19	1833-2029
20	1857-2055

AUGUST-1977	
Day	GMT
3	0640-0842
4	0748-0950
5	0855-1053
6	0957-1155
7	1055-1255
8	1151-1351
9	1244-1442
10	1334-1532
11	1419-1617
12	1459-1657
13	1535-1733
14	1607-1805
15	1637-1833
16	1703-1901
31	0529-0731

SEPTEMBER-1977	
Day	GMT
1	0636-0838
2	0742-0942
3	0844-1042
4	0942-1140
5	1036-1234
6	1127-1325
7	1212-1410
8	1255-1453
9	1333-1529
10	1405-1603
11	1437-1633
12	1504-1703
13	1531-1729
27	0312-0512
28	0420-0620
29	0527-0725
30	0629-0829

OCTOBER-1977	
Day	GMT
1	0729-0929
2	0825-1025
3	0918-1116
4	1006-1204
5	1049-1247
6	1129-1325
7	1203-1401
8	1235-1431
9	1303-1501
10	1331-1529
24	0059-0301
25	0207-0408
26	0314-0514
27	0418-0618
28	0518-0718
29	0616-0816
30	0710-0910
31	0801-0959

NOVEMBER-1977	
Day	GMT
1	0846-1044
2	0925-1123
3	1001-1159
4	1033-1231
5	1103-1301
6	1129-1327
7	1155-1353
21	0000-0201
22	0105-0305
23	0209-0409
24	0310-0510
25	0408-0608
26	0504-0702
27	0557-0753
28	0642-0840
29	0725-0923
30	0803-1001

DECEMBER-1977	
Day	GMT
1	0835-1033
2	0905-1103
3	0933-1129
4	0957-1155
18-19	2257-0057
20	0000-0201
21	0103-0303
22	0203-0401
23	0259-0457
24	0351-0549
25	0440-0638
26	0525-0723
27	0605-0803
28	0639-0837
29	0710-0908
30	0737-0935
31	0803-1001

1976	Newmoon	Perigee	Apogee
July	27	7	19
August	25	1,28	16
September	23	25	12
October	23	23	10
November	21	21	6
December	21	19	3

1977			
January	19	16	28
February	18	11	25
March	19	8-9	24
April	18	5	21
May	18	4	18
June	16	1,29-30	14
July	16		12
August	14	28	9
September	13	24	5
October	12	18	3,31
November	11	12	27
December	10	10	24

The HP2000C BASIC program (POEME) presented here
is an outgrowth of a program written by Lance Collister,
WB7CCI, using GE BASIC.   A few things were added to
help define the European, VE-W, and the JA-VK-ZL windows.
In the sample printout included, the "U" printed after
the declination column indicates the moon is in the
European Universal Window.   The "W" indicates the moon
is in the VE-W window and "J" indicates the JA-VK-ZL
window.

An ACS-3750 terminal was used to list the program.
The circumflex (a little upside down v) indicates exponen-
tiation.   On a standard model 33 eight level teletype
machine the equivalent is an up arrow obtained by a shift-N.
Statements 1080 and 1410 are examples of where this differ-
ence must be considered.   The sample printout was done on
a model 33 teletype.

```
10    DIM F[25],V[25],Y[25],Q[25],S[25]
20    DEF FNA(X)=INT(X*D5*10+.5)/10
30    DEF FNB(X)=(X-INT(X))*P5
40    LET P5=2*3.14159
50    LET D5=360/P5
60    LET R5=P5/360
70    DIM Z$[6]
80    PRINT "WHAT ARE THE STATION CALL LETTERS";
90    INPUT Z$
100   PRINT "WHAT IS YOUR LATITUDE IN DEGREES,MINUTES";
110   INPUT L5,U5
120   PRINT "WHAT IS YOUR LONGITUDE IN DEGREES,MINUTES";
130   INPUT L6,U6
140   LET L5=(L5+U5/60)*P5
150   LET L6=(L6+U6/60)*R5
160   PRINT "WHAT IS DESIRED PRINTING INCREMENT IN MINUTES";
170   INPUT I
180   PRINT "DO YOU ONLY WANT PRINTOUT WHEN THE MOON"
190   PRINT "IS NEAR THE HORIZON(1=YES,0=NO)";
200   INPUT Q1
210   IF Q1=1 THEN 250
220   IF Q1=0 THEN 230
230   LET I6=100
240   GOTO 330
250   PRINT "BELOW WHAT ELEVATION IN DEGREES DO YOU WANT PRINTOUT TO OCCUR";
260   INPUT I6
270   PRINT "WHAT ARE THE GMT MONTH,DAY,YEAR DESIRED";
280   FOR N=1 TO 25
290   INPUT F[N],V[N],Y[N]
300   IF F[N]=0 THEN 400
310   NEXT N
320   GOTO 280
330   PRINT "WHAT ARE THE GMT MONTH,DAY,YEAR,TIME INTERVAL(BEGINNING,"
340   PRINT "ENDING) DESIRED";
350   FOR N=1 TO 25
360   INPUT F[N],V[N],Y[N],Q[N],S[N]
370   IF F[N]=0 THEN 400
380   NEXT N
390   GOTO 350
400   LET N5=N-1
410   FOR N=1 TO N5
420   IF Q1=1 THEN 440
430   GOTO 470
440   LET E1=2400
450   LET B=0
460   GOTO 490
470   LET E1=S[N]
480   LET B=Q[N]
490   LET M=F[N]
500   LET D=V[N]
510   LET Y=Y[N]
520   LET Y1=Y-(INT(Y/100)*100)
530   PRINT
540   PRINT
550   IMAGE "POSITION OF THE MOON ON:",2D,"/",2D,"/",4D
560   PRINT  USING 550;M,D,Y
```

```
570    PRINT
580    PRINT "GMT","AZ","EL","GHA","DEC"
590    PRINT "---","--","--","---","---"
600    PRINT
610    LET I1=2
620    REM:HERE BEGINS CALCULATION OF JULIAN DATE
630    IF M >= 3 THEN 710
640    IF INT((Y-1853)/4)<11 THEN 670
650    LET C1=-1
660    GOTO 680
670    LET C1=0
680    LET J1=365*(Y-1853)+D+30*(M+9)+INT((M+10)/2)
690    LET J2=INT((Y-1853)/4)+1+C1
700    GOTO 820
710    IF INT((Y-1852)/4)<11 THEN 740
720    LET C1=-1
730    GOTO 750
740    LET C1=0
750    IF M=9 THEN 790
760    IF M=11 THEN 790
770    LET C2=0
780    GOTO 800
790    LET C2=1
800    LET J1=365*(Y-1852)+D+30*(M-3)+INT((M-2)/2)
810    LET J2=INT((Y-1852)/4)+C1+C2
820    LET J=J1+J2
830    LET T1=J-17472.5
840    LET D9=(B-INT(B/100)*100)+INT(B/100)*60
850    LET D6=(E1-INT(E1/100)*100)+INT(E1/100)*60
860    LET D7=D9-D6
870    LET D8=D7-I
880    IF D7>0 THEN 900
890    GOTO 930
900    IF D8 >= 0 THEN 1860
910    LET B=E1
920    REM:CALCULATION OF LATITUDE AND LONGITUDE OF MOON
930    LET T=(B-INT(B/100)*100)/1440+INT(B/100)/24
940    LET T5=T1+T
950    LET K1=FNB(.751213+3.66011E-02*T5)
960    LET K2=FNB(.822513+3.62916E-02*T5)
970    LET K3=FNB(.995766+2.73778E-03*T5)
980    LET K4=FNB(.974271+3.38632E-02*T5)
990    LET K5=FNB(3.12525E-02+3.67482E-02*T5)
1000   LET L8=K1+.658*R5*SIN(2*K4)+6.289*R5*SIN(K2)
1010   LET L8=L8-1.274*R5*SIN(K2-2*K4)-.186*R5*SIN(K3)
1020   LET L8=L8+.214*R5*SIN(2*K2)-.114*R5*SIN(2*K5)
1030   LET L8=L8-.059*R5*SIN(2*K2-2*K4)-.057*R5*SIN(K2+K3-2*K4)
1040   LET K6=K5+.6593*R5*SIN(2*K4)+6.2303*R5*SIN(K2)-1.272*R5*SIN(K2-2*K4)
1050   LET L7=5.144*R5*SIN(K6)-.146*R5*SIN(K5-2*K4)
1060   REM:CALCULATION OF RIGHT ASCENSION (A=R1) AND DECLINATION(D1)
1070   LET D1=COS(L7)*SIN(L8)*.397821+SIN(L7)*.917463
1080   LET D1=ATN(D1/(SQR(1-D1^2)))
1090   LET G1=50.5+((D1)/(.792))*D5
1100   LET G2=80+((D1)/(.808))*D5
1110   LET G3=141.5-((D1)*(.738)*D5)
1120   LET G4=170.5-((D1)*(.857)*D5)
1130   LET A2=COS(L7)*COS(L8)/COS(D1)
1140   LET A1=(COS(L7)*SIN(L8)*.917463-SIN(L7)*.397821)/COS(D1)
```

```
1150    LET A=ATN(A1/A2)
1160    GOSUB 1450
1170    LET R1=A
1180    LET L1=6.57098E-02*T1
1190    LET L=T*24*1.00274+6.64606+(L1-INT(L1/24)*24)
1200    LET L=(L-INT(L/24)*24)
1210    REM:CALCULATION OF GREENWICH HOUR ANGLE,G,FROM LOCAL SIDERAL TIME
1220    LET G=(L/24)*P5-R1
1230    IF G<P5 THEN 1260
1240    G=G-P5
1250    GOTO 1300
1260    IF G<0 THEN 1280
1270    GOTO 1300
1280    G=G+P5
1290    REM:CALCULATION OF YOUR LOCAL HOUR ANGLE,H, FROM GHA
1300    LET H=L6-G
1310    REM:CALCULATION OF ELEVATION,E,OF OBJECT
1320    LET E3=COS(L5)*COS(H)*COS(D1)+SIN(D1)*SIN(L5)
1330    LET E2=SQR(1-(E3*E3))
1340    LET E=ATN(E3/E2)
1350    IF E<0 THEN 1810
1360    IF E>I6*R5 THEN 1810
1370    REM:CALCULATION OF AZIMUTH,A,OF OBJECT
1380    LET A2=SIN(D1)/(COS(L5)*COS(E))
1390    LET A2=A2-(SIN(L5)/COS(L5))*(SIN(E)/COS(E))
1400    LET A1=SIN(L5)*SIN(D1)+COS(L5)*COS(D1)*COS(H)
1410    LET A1=(SIN(H)*COS(D1))/(SQR(1-A1^2))
1420    LET A=ATN(A1/A2)
1430    GOSUB 1450
1440    GOTO 1610
1450    REM:REMOVAL OF AMBIGUITIES INCURRED WITH ATN FUNCTION
1460    IF A=0 THEN 1480
1470    GOTO 1520
1480    IF A2<0 THEN 1500
1490    GOTO 1600
1500    LET A=P5/2
1510    GOTO 1600
1520    IF A>0 THEN 1580
1530    IF A2<0 THEN 1560
1540    LET A=P5+A
1550    GOTO 1600
1560    LET A=P5+(A-P5/2)
1570    GOTO 1600
1580    IF A2 >= 0 THEN 1600
1590    LET A=A+P5/2
1600    RETURN
1610    IF (T-I1)>(2*I)/1440 THEN 1630
1620    GOTO 1640
1630    PRINT
1640    IF FNA(D1)<0 THEN 1770
1650    IF FNA(G)<G1 THEN 1770
1660    IF FNA(G)>G2 THEN 1680
1670    GOTO 1710
1680    IF FNA(G)<G3 THEN 1730
1690    IF FNA(G)>G4 THEN 1770
1700    GOTO 1750
1710    LET S$="U"
1720    GOTO 1790
```

```
1730    LET S$="W"
1740    GOTO 1790
1750    LET S$="J"
1760    GOTO 1790
1770    LET S$=" "
1780    IMAGE 4D10X,3D.D10X,2D.D11X,3D.D10X,3D.D,A
1790    PRINT  USING 1780;INT(B+.5),FNA(A),FNA(E),FNA(G),FNA(D1),S$
1800    LET I1=T
1810    LET B=B+I
1820    LET Z=(B-INT(B/100)*100)-60
1830    IF Z<0 THEN 840
1840    LET B=INT(B/100)*100+100+Z
1850    GOTO 840
1860    NEXT N
1870    LET N=0
1880    PRINT
1890    PRINT
1900    PRINT
1910    PRINT "DO YOU WANT MORE INFORMATION(1=YES,0=NO)";
1920    INPUT Q2
1930    IF Q2=1 THEN 20
1940    IF Q2=0 THEN 1950
1950    END
```

POEME

WHAT ARE THE STATION CALL LETTERS?W6PO
WHAT IS YOUR LATITUDE IN DEGREES,MINUTES?37,34
WHAT IS YOUR LONGITUDE IN DEGREES,MINUTES?122,18
WHAT IS DESIRED PRINTING INCREMENT IN MINUTES?15
DO YOU ONLY WANT PRINTOUT WHEN THE MOON
IS NEAR THE HORIZON(1=YES,0=NO)?0
WHAT ARE THE GMT MONTH,DAY,YEAR,TIME INTERVAL(BEGINNING,
ENDING) DESIRED?12,13,1976,0000,2400
?0,0,0,0,0

POSITION OF THE MOON ON:12/13/1976

GMT	AZ	EL	GHA	DEC
700	84.5	1.0	29.7	5.0
715	86.8	3.9	33.4	4.9
730	89.0	6.7	37.0	4.9
745	91.3	9.6	40.7	4.8
800	93.5	12.4	44.3	4.8
815	95.8	15.3	47.9	4.8
830	98.2	18.1	51.5	4.7
845	100.6	20.9	55.2	4.7
900	103.1	23.7	58.8	4.6U
915	105.7	26.4	62.4	4.6U
930	108.4	29.2	66.1	4.5U
945	111.2	31.8	69.7	4.5U
1000	114.2	34.5	73.3	4.4U
1015	117.3	37.0	76.9	4.4U
1030	120.7	39.5	80.6	4.4U
1045	124.3	41.9	84.2	4.3U
1100	128.1	44.2	87.9	4.3W
1115	132.2	46.3	91.5	4.2W
1130	136.6	48.3	95.1	4.2W
1145	141.4	50.2	98.7	4.1W
1200	146.5	51.8	102.3	4.1W
1215	152.0	53.3	106.0	4.0W
1230	157.8	54.5	109.6	4.0W
1245	164.0	55.4	113.3	4.0W
1300	170.3	56.0	116.9	3.9W
1315	176.8	56.3	120.5	3.9W
1330	183.3	56.2	124.1	3.8W
1345	189.6	55.8	127.7	3.7W
1400	196.0	55.1	131.4	3.7W
1415	202.0	54.2	135.0	3.7W
1430	207.6	52.9	138.6	3.6W
1445	213.1	51.4	142.2	3.6J
1500	218.2	49.7	145.9	3.5J
1515	222.8	47.8	149.5	3.5J
1530	227.2	45.7	153.2	3.5J
1545	231.2	43.5	156.8	3.4J
1600	234.9	41.2	160.4	3.3J
1615	238.4	38.7	164.0	3.3J
1630	241.7	36.2	167.6	3.3J
1645	244.7	33.6	171.2	3.2
1700	247.7	31.0	174.9	3.2
1715	250.4	28.3	178.5	3.1
1730	253.1	25.5	182.2	3.1
1745	255.6	22.7	185.8	3.1
1800	258.0	19.9	189.4	3.0
1815	260.3	17.0	193.0	2.9
1830	262.7	14.1	196.7	2.9
1845	264.9	11.3	200.3	2.8
1900	267.1	8.4	203.9	2.8
1915	269.3	5.4	207.5	2.8
1930	271.4	2.6	211.1	2.7

DO YOU WANT MORE INFORMATION(1=YES,0=NO)?0