

~~CONFIDENTIAL~~

TECHNICAL PUBLICATION



~~CONFIDENTIAL~~

DETERMINING
SUN ALTITUDE GIVEN
DATE, TIME, LATITUDE,
AND LONGITUDE

NPIC/R-5018/66

JULY 1966

GROUP 1 EXCLUDED FROM
AUTOMATIC DOWNGRADING
AND DECLASSIFICATION

~~CONFIDENTIAL~~

WARNING

This document contains information affecting the national defense of the United States, within the meaning of Title 18, sections 793 and 794, of the U.S. Code, as amended. Its transmission or revelation of its contents to or receipt by an unauthorized person is prohibited by law.

DETERMINING SUN ALTITUDE GIVEN DATE, TIME, LATITUDE, AND LONGITUDE

1. Convert GCT to local time as follows:

Local time = GCT - λw or

Local time = GCT $\pm \lambda e$

where λw is longitude west and λe is longitude east, whichever is applicable. Longitude in degrees and minutes is converted to hours and minutes by dividing degrees by 15, since 15° longitude equals one hour in time. E.g. $6^h 30^m$ GCT - $82 \frac{1}{2}^\circ \lambda w = 6^h 30^m - 5^h 30^m = 1^h 0^m$ local time, or 1:00 a.m.

2. Compute time interval from local time to noon*, and use Table 1 to convert this interval to hour angle (H.A.).

E.g. 9:24 a.m. local time = $2^h 36^m$ from noon = 39°

1:00 a.m. local time = $11^h 00^m$ from noon = 165°

3. Using Table 2, the apparent declination of the sun for 0^h ephemeris time, find the declination angle for the correct date.

ation angle for the correct date.

4. Using H.O. 214, look for the latitude given in the mission data. If the sign of the apparent declination and the given latitude are the same, use the table designated "same name." If the signs are opposite, use the table labelled "contrary name."

Find the column headed by the smaller of the 2 nearest declination angles. Find the row headed by the smaller of the 2 nearest hour angles (H.A.).

Interpolate thusly: Each value in the table is followed by a Δd and a Δt value.

Subtract the angle at the head of the column from the apparent declination and multiply this difference by Δd .

Subtract the hour angle at the head of the row from the computed hour angle (step 2) and multiply by Δt .

To the table value for sun altitude add the computed Δd value and subtract the computed Δt value to get the interpolated sun altitude.

*Compute this time interval, using noon of the day to which the given GCT is referenced. Thus if the computed local time falls on the previous or following day, the time interval will be greater than 12 hours.

TABLE 1. FOR CONVERSION OF TIME TO ARC

°	h m	°	h m	°	h m	°	h m	°	h m	°	h m
0	0 0	60	4 0	120	8 0	180	12 0	240	16 0	300	20 0
1	0 4	61	4 4	121	8 4	181	12 4	241	16 4	301	20 4
2	0 8	62	4 8	122	8 8	182	12 8	242	16 8	302	20 8
3	0 12	63	4 12	123	8 12	183	12 12	243	16 12	303	20 12
4	0 16	64	4 16	124	8 16	184	12 16	244	16 16	304	20 16
5	0 20	65	4 20	125	8 20	185	12 20	245	16 20	305	20 20
6	0 24	66	4 24	126	8 24	186	12 24	246	16 24	306	20 24
7	0 28	67	4 28	127	8 28	187	12 28	247	16 28	307	20 28
8	0 32	68	4 32	128	8 32	188	12 32	248	16 32	308	20 32
9	0 36	69	4 36	129	8 36	189	12 36	249	16 36	309	20 36
10	0 40	70	4 40	130	8 40	190	12 40	250	16 40	310	20 40
11	0 44	71	4 44	131	8 44	191	12 44	251	16 44	311	20 44
12	0 48	72	4 48	132	8 48	192	12 48	252	16 48	312	20 48
13	0 52	73	4 52	133	8 52	193	12 52	253	16 52	313	20 52
14	0 56	74	4 56	134	8 56	194	12 56	254	16 56	314	20 56
15	1 0	75	5 0	135	9 0	195	13 0	255	17 0	315	21 0
16	1 4	76	5 4	136	9 4	196	13 4	256	17 4	316	21 4
17	1 8	77	5 8	137	9 8	197	13 8	257	17 8	317	21 8
18	1 12	78	5 12	138	9 12	198	13 12	258	17 12	318	21 12
19	1 16	79	5 16	139	9 16	199	13 16	259	17 16	319	21 16
20	1 20	80	5 20	140	9 20	200	13 20	260	17 20	320	21 20
21	1 24	81	5 24	141	9 24	201	13 24	261	17 24	321	21 24
22	1 28	82	5 28	142	9 28	202	13 28	262	17 28	322	21 28
23	1 32	83	5 32	143	9 32	203	13 32	263	17 32	323	21 32
24	1 36	84	5 36	144	9 36	204	13 36	264	17 36	324	21 36
25	1 40	85	5 40	145	9 40	205	13 40	265	17 40	325	21 40
26	1 44	86	5 44	146	9 44	206	13 44	266	17 44	326	21 44
27	1 48	87	5 48	147	9 48	207	13 48	267	17 48	327	21 48
28	1 52	88	5 52	148	9 52	208	13 52	268	17 52	328	21 52
29	1 56	89	5 56	149	9 56	209	13 56	269	17 56	329	21 56
30	2 0	90	6 0	150	10 0	210	14 0	270	18 0	330	22 0
31	2 4	91	6 4	151	10 4	211	14 4	271	18 4	331	22 4
32	2 8	92	6 8	152	10 8	212	14 8	272	18 8	332	22 8
33	2 12	93	6 12	153	10 12	213	14 12	273	18 12	333	22 12
34	2 16	94	6 16	154	10 16	214	14 16	274	18 16	334	22 16
35	2 20	95	6 20	155	10 20	215	14 20	275	18 20	335	22 20
36	2 24	96	6 24	156	10 24	216	14 24	276	18 24	336	22 24
37	2 28	97	6 28	157	10 28	217	14 28	277	18 28	337	22 28
38	2 32	98	6 32	158	10 32	218	14 32	278	18 32	338	22 32
39	2 36	99	6 36	159	10 36	219	14 36	279	18 36	339	22 36
40	2 40	100	6 40	160	10 40	220	14 40	280	18 40	340	22 40
41	2 44	101	6 44	161	10 44	221	14 44	281	18 44	341	22 44
42	2 48	102	6 48	162	10 48	222	14 48	282	18 48	342	22 48
43	2 52	103	6 52	163	10 52	223	14 52	283	18 52	343	22 52
44	2 56	104	6 56	164	10 56	224	14 56	284	18 56	344	22 56
45	3 0	105	7 0	165	11 0	225	15 0	285	19 0	345	23 0
46	3 4	106	7 4	166	11 4	226	15 4	286	19 4	346	23 4
47	3 8	107	7 8	167	11 8	227	15 8	287	19 8	347	23 8
48	3 12	108	7 12	168	11 12	228	15 12	288	19 12	348	23 12
49	3 16	109	7 16	169	11 16	229	15 16	289	19 16	349	23 16
50	3 20	110	7 20	170	11 20	230	15 20	290	19 20	350	23 20
51	3 24	111	7 24	171	11 24	231	15 24	291	19 24	351	23 24
52	3 28	112	7 28	172	11 28	232	15 28	292	19 28	352	23 28
53	3 32	113	7 32	173	11 32	233	15 32	293	19 32	353	23 32
54	3 36	114	7 36	174	11 36	234	15 36	294	19 36	354	23 36
55	3 40	115	7 40	175	11 40	235	15 40	295	19 40	355	23 40
56	3 44	116	7 44	176	11 44	236	15 44	296	19 44	356	23 44
57	3 48	117	7 48	177	11 48	237	15 48	297	19 48	357	23 48
58	3 52	118	7 52	178	11 52	238	15 52	298	19 52	358	23 52
59	3 56	119	7 56	179	11 56	239	15 56	299	19 56	359	23 56

CONFIDENTIAL

NPIC/R-5018/66

TABLE 2. SUN, 1966 FOR 0^h EPHEMERIS TIME

Date	Apparent Declination			Date	Apparent Declination		
	Deg.	Min.	Sec.		Deg.	Min.	Sec.
Jan. 1	-23	07	57.0	Mar. 6	7	55	28.0
2	23	03	32.0	7	-5	32	13.8
2	22	58	39.3	8	5	08	55.2
3	22	53	19.1	9	4	45	32.5
4	22	47	31.6	10	4	22	06.1
5	-22	41	17.0	11	3	58	36.3
6	22	34	35.4	12	-3	35	03.5
7	22	27	27.2	13	3	11	27.9
8	22	19	52.5	14	2	47	50.1
9	22	11	51.4	15	2	24	10.4
10	-22	03	24.3	16	2	00	29.1
11	21	54	31.3	17	-1	36	46.6
12	21	45	12.8	18	1	13	03.4
13	21	35	28.8	19	0	49	19.7
14	21	25	19.8	20	0	25	36.1
15	-21	14	45.9	21	-0	01	52.7
16	21	03	47.5	22	+0	21	49.9
17	20	52	24.9	23	0	45	31.3
18	20	41	38.4	24	0	09	11.3
19	20	28	28.3	25	1	32	49.5
20	-20	15	55.0	26	1	56	25.4
21	20	02	58.8	27	+2	19	58.6
22	19	49	40.0	28	2	43	28.9
23	19	35	59.1	29	3	06	55.8
24	19	21	56.4	30	3	30	18.9
25	-19	07	32.2	31	3	53	37.9
26	18	52	47.0	Apr. 1	+4	16	52.5
27	18	37	41.2	2	+4	40	02.2
28	18	22	15.1	3	5	03	06.7
29	18	06	29.0	4	5	26	05.7
30	-17	50	23.6	5	5	48	59.0
31	17	33	59.0	6	+6	11	46.1
Feb. 1	17	17	15.9	7	6	34	26.8
2	17	00	14.5	8	6	57	00.9
3	16	42	55.3	9	7	19	28.0
4	-16	25	18.7	10	7	41	47.6
5	16	07	25.1	11	+8	03	59.7
6	15	49	14.9	12	8	26	03.8
7	15	30	48.6	13	8	47	59.5
8	15	12	06.3	14	9	09	46.5
9	-14	53	08.6	15	9	31	24.6
10	14	33	55.9	16	+9	52	53.2
11	14	14	28.4	17	10	14	12.1
12	13	54	46.7	18	10	35	21.0
13	13	34	51.1	19	10	56	19.4
14	-13	14	42.1	20	11	17	07.2
15	-12	54	20.0	21	+11	37	43.7
16	12	33	45.3	22	11	58	08.8
17	12	12	58.4	23	12	18	22.2
18	11	51	59.8	24	12	38	23.3
19	11	30	49.8	25	12	58	11.9
20	-11	09	28.9	26	+13	17	47.7
21	10	47	57.6	27	13	37	10.2
22	10	26	16.2	28	13	56	19.1
23	10	04	25.2	29	14	15	14.2
24	9	42	24.9	30	14	33	55.1
25	-9	20	15.8	May 1	+14	52	21.4
26	8	57	58.4	2	15	10	32.8
27	8	35	33.1	3	15	28	29.1
28	8	13	00.2	4	15	46	10.0
Mar. 1	7	50	20.2	5	16	03	35.3
2	-7	27	33.5	6	+16	20	44.5
3	7	04	40.6	7	16	37	37.6
4	6	41	41.7	8	16	54	14.1
5	6	18	37.4	9	17	10	33.8

CONFIDENTIAL

TABLE 2 (Continued).

Date		Apparent Declination			Date		Apparent Declination		
		Deg.	Min.	Sec.			Deg.	Min.	Sec.
May	10	17	26	36.4	July	14	21	47	13.8
	11	+17	42	21.6		15	21	38	12.6
	12	17	57	49.2		16	+21	28	49.2
	13	18	12	58.7		17	21	19	03.9
	14	18	27	50.0		18	21	08	56.8
	15	18	42	22.7		19	20	58	28.1
	16	+18	56	36.5		20	20	47	38.2
	17	+19	10	31.1		21	+20	36	27.3
	18	19	24	06.3		22	20	24	55.6
	19	19	37	21.8		23	20	13	03.3
	20	19	50	17.3		24	20	00	50.7
	21	20	02	52.5		25	19	48	18.2
	22	+20	15	07.1		26	+19	35	25.9
	23	20	27	01.0		27	19	22	14.2
	24	20	38	33.8		28	19	08	43.2
	25	20	49	45.3	Aug.	29	18	54	53.4
	26	21	00	35.2		30	18	40	45.0
	27	+21	11	03.2		31	+18	26	18.2
	28	21	21	09.3		1	18	11	33.4
	29	21	30	53.0		2	17	56	30.8
	30	21	40	14.4		3	17	41	10.7
	31	21	49	13.1		4	17	25	33.4
June	1	+21	57	49.0		5	+17	09	39.0
	2	22	06	01.9		6	16	53	28.0
	3	22	13	51.8		7	16	37	00.5
	4	22	21	18.5		8	16	20	16.9
	5	22	28	21.7		9	16	03	17.5
	6	+22	35	01.4		10	+15	46	02.4
	7	22	41	17.5		11	15	28	32.2
	8	22	47	09.7		12	15	10	26.9
	9	22	52	38.0		13	14	52	47.1
	10	22	57	42.3		14	14	34	32.8
	11	+23	02	22.4		15	+14	16	04.6
	12	23	06	38.1		16	+13	57	22.7
	13	23	10	29.5		17	13	38	27.5
	14	23	13	56.4		18	13	19	19.3
	15	23	16	58.7		19	12	59	58.3
	16	+23	19	36.3		20	12	40	25.1
	17	23	21	49.3		21	+12	20	39.8
	18	23	23	37.5		22	12	00	42.9
	19	23	23	01.0		23	11	40	34.7
	20	23	25	59.6		24	11	20	15.4
	21	+23	26	33.4		25	10	59	45.5
	22	23	26	42.4		26	+10	39	05.3
	23	23	26	26.5		27	10	18	15.1
	24	23	25	45.8		28	9	57	15.1
	25	23	24	40.2		29	9	36	05.8
	26	+23	23	09.9		30	9	14	47.4
	27	23	21	14.9		31	+8	53	20.2
	28	23	18	55.2	Sept.	1	8	31	44.5
	29	23	16	10.9		2	8	10	00.6
	30	23	13	02.1		3	7	48	08.8
July	1	+23	09	29.0		4	7	26	09.4
	2	23	05	31.6		5	+7	04	02.7
	3	23	01	10.1		6	6	41	49.0
	4	22	56	24.5		7	6	19	28.7
	5	22	51	15.0		8	5	57	01.9
	6	+22	45	41.6		9	5	34	29.0
	7	22	39	44.6		10	+5	11	50.5
	8	22	33	23.9		11	4	49	06.5
	9	22	26	39.9		12	4	26	17.4
	10	22	19	32.6		13	4	03	23.6
	11	+22	12	02.1		14	3	40	25.5
	12	22	04	08.7		15	+3	17	23.4
	13	21	55	52.5		16	2	54	17.5

TABLE 2 (Continued).

Date	Apparent Declination			Date	Apparent Declination		
	Deg.	Min.	Sec.		Deg.	Min.	Sec.
Sept. 17	2	31	08.4	Nov. 10	-16	57	21.5
18	2	07	56.4	11	17	14	16.8
19	1	44	41.8	12	17	30	54.5
20	+1	21	25.0	13	17	47	14.0
21	0	58	06.3	14	18	03	15.0
22	0	34	46.1	15	-18	18	57.1
23	+0	11	24.8	16	-18	34	19.9
24	-0	11	57.3	17	18	49	22.9
25	-0	35	20.0	18	19	04	05.7
26	0	58	42.7	19	19	18	28.0
27	1	22	05.3	20	19	32	29.4
28	1	45	27.4	21	-19	46	09.5
29	2	08	48.6	22	19	59	28.0
30	-2	32	08.7	23	20	12	24.4
Oct. 1	-2	55	27.3	24	20	24	58.5
2	3	55	44.1	25	20	37	09.9
3	3	41	58.8	26	-20	48	58.3
4	4	05	11.0	27	21	00	23.4
5	4	28	20.5	28	21	11	24.9
6	-4	51	26.8	29	21	22	02.5
7	5	14	29.7	30	21	32	15.9
8	5	37	28.7	Dec. 1	-21	42	04.8
9	6	00	23.6	2	21	51	29.0
10	6	23	13.9	3	22	00	28.1
11	-6	45	59.2	4	22	09	01.8
12	7	08	39.2	5	22	17	10.0
13	7	31	13.4	6	-22	24	52.3
14	7	53	41.5	7	22	32	08.4
15	8	16	03.1	8	22	38	58.1
16	-8	38	17.7	9	22	45	21.3
17	9	00	24.9	10	22	51	17.7
18	9	22	24.3	11	-22	56	47.0
19	9	44	15.6	12	23	01	49.1
20	10	05	58.2	13	23	06	23.8
21	-10	27	31.9	14	23	10	31.0
22	10	48	56.2	15	23	14	10.5
23	11	10	10.7	16	-23	17	22.1
24	11	31	15.0	17	23	20	05.8
25	11	52	08.7	18	23	22	21.4
26	12	12	51.5	19	23	24	08.9
27	12	33	23.0	20	23	25	28.2
28	12	53	42.8	21	-23	26	19.3
29	13	13	50.4	22	23	26	42.1
30	13	33	45.7	23	23	26	36.7
31	-13	53	28.1	24	23	26	02.9
Nov. 1	14	12	57.3	25	23	25	00.9
2	14	32	13.0	26	-23	23	30.8
3	14	51	14.6	27	23	21	32.4
4	15	10	01.9	28	23	19	06.0
5	-15	28	34.5	29	23	16	11.5
6	15	46	51.9	30	23	12	49.2
7	16	04	53.7	31	23	08	58.9
8	16	22	39.5	32	-23	04	40.9
9	16	40	09.0				

TABLE 3. SUN, 1967 FOR 0^h EPHEMERIS TIME

Date	Apparent Declination			Date	Apparent Declination		
	Deg	Min.	Sec.		Deg.	Min.	Sec.
Jan. 0	-23	08	58.9	Mar. 5	6	24	17.4
1	23	04	40.9	6	6	01	08.4
2	22	59	55.3	7	-5	37	54.4
3	22	54	42.1	8	5	14	35.7
4	22	49	01.6	9	4	51	12.7
5	-22	42	53.8	10	4	27	46.0
6	22	36	18.9	11	4	04	15.8
7	22	29	17.1	12	-3	40	42.5
8	22	21	48.7	13	3	17	06.7
9	22	13	53.8	14	2	53	28.5
10	-22	05	32.7	15	2	29	48.5
11	21	56	45.7	16	2	06	07.1
12	21	47	33.0	17	1	42	24.5
13	21	37	54.8	18	1	18	41.3
14	21	27	51.4	19	0	54	57.8
15	-21	17	23.2	20	0	31	14.3
16	21	06	30.5	21	0	07	31.4
17	20	55	13.5	22	+0	16	10.7
18	20	43	32.6	23	0	39	51.7
19	20	31	28.1	24	1	03	30.1
20	-20	19	00.3	25	1	27	08.6
21	20	06	09.7	27	+2	14	16.7
22	19	52	56.6	28	2	37	46.7
23	19	39	21.2	29	3	01	13.5
24	19	25	24.1	30	3	24	37.0
25	-19	11	05.6	31	3	47	56.7
26	18	56	25.9	Apr. 1	+4	11	12.3
27	18	41	25.7	2	+4	34	23.4
28	18	26	05.0	3	4	57	58.7
29	18	10	24.4	4	5	20	30.9
30	-17	54	24.2	5	5	32	26.5
31	17	38	04.7	6	+6	06	16.2
Feb. 1	17	21	26.3	7	6	28	59.7
2	17	04	29.4	8	6	51	36.6
3	16	47	14.4	9	7	14	06.5
4	-16	29	41.7	10	7	36	29.0
5	16	11	51.7	11	+7	58	43.9
6	15	53	44.8	12	8	20	50.8
7	15	35	21.5	13	8	42	49.2
8	15	16	42.2	14	9	04	38.8
9	-14	57	47.3	15	9	26	19.4
10	14	38	37.2	16	+9	47	50.4
11	14	19	12.5	17	10	09	11.7
12	13	59	33.4	18	10	30	22.7
13	13	59	40.4	19	10	51	23.2
14	-13	19	34.0	20	11	12	12.7
15	-12	59	14.7	21	+11	32	51.1
16	12	38	42.7	22	11	53	18.0
17	12	17	58.7	23	12	13	33.1
18	11	57	02.9	24	12	33	36.0
19	11	35	55.8	25	12	53	26.6
20	-11	14	37.9	26	+13	13	04.5
21	10	53	09.6	27	13	32	29.4
22	10	31	31.2	28	13	51	41.1
23	10	09	43.3	29	14	10	39.2
24	9	47	46.1	30	14	29	23.4
25	-9	25	40.1	May 1	+14	47	53.5
26	9	03	25.6	2	15	06	08.9
27	8	41	03.0	3	15	24	09.6
28	8	18	32.6	4	15	41	55.0
Mar. 1	7	55	54.9	5	15	59	24.9
2	-7	33	10.1	6	+16	16	39.0
3	7	10	18.6	7	16	33	36.9
4	6	47	20.9				

TABLE 3 (Continued).

Date		Apparent Declination		
		Deg.	Min.	Sec.
May	8	16	50	18.3
	9	17	06	42.9
	10	17	22	50.4
	11	+17	38	40.4
	12	17	54	12.7
	13	18	09	26.9
	14	18	24	22.8
	15	18	39	00.1
	16	+18	53	18.3
	17	+19	07	17.3
	18	19	20	56.7
	19	19	34	16.4
	20	19	47	16.0
	21	19	59	55.3
	22	+20	12	14.0
	23	20	24	12.1
	24	20	35	49.2
	25	20	47	05.2
	26	20	57	59.8
	27	+21	08	32.8
	28	21	18	44.0
	29	21	28	33.2
	30	21	38	00.2
	31	21	47	04.8
June	1	+21	55	46.7
	2	22	04	05.7
	3	22	12	01.7
	4	22	19	34.6
	5	22	26	44.0
	6	+22	33	29.8
	7	22	39	52.0
	8	22	45	50.3
	9	22	51	24.6
	10	22	56	34.8
	11	+23	01	20.8
	12	23	05	42.4
	13	23	09	39.5
	14	23	13	12.1
	15	23	16	20.2
	16	+23	19	03.5
	17	23	21	22.1
	18	23	23	15.9
	19	23	24	44.9
	20	23	25	49.2
	21	+23	26	28.7
	22	23	26	43.4
	23	23	26	33.4
	24	23	25	58.7
	25	23	24	59.3
	26	+23	23	35.2
	27	23	21	46.4
	28	23	19	33.0
	29	23	16	55.0
July	30	23	13	52.5
	1	+23	10	25.5
	2	+23	06	34.2
	3	23	02	18.6
	4	22	57	38.8
	5	22	52	34.9
	6	+22	47	07.2
	7	22	41	15.6
	8	22	35	00.4
	9	22	28	21.7
	10	22	21	19.7
Date		Apparent Declination		
		Deg.	Min.	Sec.
July	11	+22	13	54.4
	12	22	06	06.4
	13	21	57	55.4
	14	21	49	21.9
	15	21	40	26.0
	16	+21	31	07.9
	17	21	21	27.8
	18	21	11	26.1
	19	21	01	02.9
	20	20	50	18.4
	21	+20	39	13.0
	22	20	27	46.8
	23	20	16	00.0
	24	20	03	53.0
	25	19	51	25.8
	26	+19	38	38.8
	27	19	25	32.2
	28	19	12	06.2
	29	18	58	21.2
	30	18	44	17.3
	31	+18	29	54.8
Aug.	1	18	15	14.0
	2	18	00	15.3
	3	17	44	58.8
	4	17	29	25.0
	5	+17	13	34.0
	6	16	57	26.2
	7	16	41	02.0
	8	16	24	21.6
	9	16	07	25.3
	10	+15	50	13.5
	11	15	32	46.5
	12	15	15	04.7
	13	14	57	08.3
	14	14	38	57.6
	15	+14	20	33.1
	16	+14	01	55.0
	17	13	43	03.6
	18	13	23	59.3
	19	13	04	42.4
	20	12	45	13.1
	21	+12	25	31.7
	22	12	05	38.5
	23	11	45	33.8
	24	11	25	17.9
	25	11	04	51.1
	26	+10	44	13.7
	27	10	23	25.9
	28	10	02	28.2
	29	9	41	20.8
	30	9	20	04.0
	31	+8	58	38.1
Sept.	1	8	37	03.6
	2	8	15	20.6
	3	7	53	29.7
	4	7	31	31.0
	5	+7	09	25.0
	6	6	47	11.9
	7	6	24	52.3
	8	6	02	26.3
	9	5	39	54.4
	10	+5	17	16.9
	11	4	54	34.1
	12	4	31	46.5

TABLE 3 (Continued).

Date	Apparent Declination			Date	Apparent Declination		
	Deg.	Min.	Sec.		Deg.	Min.	Sec.
Sept. 13	4	08	54.3	Nov. 8	16	18	29.3
14	3	45	57.9	9	16	36	02.5
15	+3	22	57.5	10	-16	53	18.8
16	2	59	53.6	11	17	10	17.7
17	2	36	46.4	12	17	26	59.0
18	2	13	36.2	13	17	43	22.1
19	1	50	23.3	14	17	59	26.8
20	+1	27	08.1	15	-18	15	12.6
21	1	03	50.7	16	-18	30	39.2
22	0	40	31.7	17	18	45	46.2
23	+5	17	11.1	18	19	00	33.3
24	-0	06	10.6	19	19	15	00.1
25	-0	29	33.1	20	19	29	06.3
26	0	52	56.6	21	-19	42	51.4
27	1	16	19.1	22	19	56	15.1
28	1	39	42.0	23	20	09	17.1
29	2	03	04.4	24	20	21	57.0
30	-2	26	25.8	25	20	34	14.5
Oct. 1	-2	49	46.0	26	-20	46	09.1
2	2	13	04.6	27	20	57	40.6
3	3	36	21.1	28	21	08	48.5
4	3	59	35.2	29	21	19	32.6
5	4	22	46.5	30	21	29	52.5
6	-4	45	54.7	Dec. 1	-21	39	47.9
7	5	08	59.2	2	21	49	18.6
8	5	31	59.8	3	21	58	24.1
9	5	54	56.1	4	22	07	04.2
10	6	17	47.6	5	22	15	18.7
11	-6	40	33.9	6	-22	23	07.2
12	7	03	14.8	7	22	30	29.5
13	7	25	49.8	8	22	37	25.4
14	7	48	18.5	9	22	43	54.7
15	8	10	40.7	10	22	49	57.1
16	-8	32	55.9	11	-22	55	32.4
17	8	55	03.9	12	23	00	40.7
18	9	17	04.2	13	23	05	21.5
19	9	38	56.4	14	23	09	34.8
20	10	00	40.4	15	23	13	20.5
21	-10	22	15.5	16	-23	16	38.6
22	10	43	41.7	17	23	19	28.8
23	11	04	58.3	18	23	21	51.0
24	11	26	05.1	19	23	23	45.3
25	11	47	01.6	20	23	25	11.5
26	-12	07	47.6	21	-23	26	09.5
27	12	28	22.5	22	23	26	39.4
28	12	48	46.0	23	23	26	41.1
29	13	08	57.7	24	23	26	14.5
30	13	28	57.0	25	23	25	19.6
31	-13	48	43.7	26	-23	23	56.4
Nov. 1	14	08	17.3	27	23	22	05.0
2	14	27	37.4	28	23	19	45.4
3	14	46	43.5	29	23	16	57.6
4	15	05	35.2	30	23	13	41.8
5	-15	24	12.0	31	-23	09	58.0
6	15	42	33.6	32	-23	-5	46.4
7	16	00	39.5				

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~