

Use of Pub 229 for sight reduction in the Starpath Cel Nav Book.

In our course we initially focus on Pub 249 for sight reduction using Form 104. That form, however, also provides spaces for using Pub 229 to get the d-correction to Hc from Pub 229. It is the gray box in the middle of the form. The overall process is essentially the same, but when recording tab Hc, d, and Z we get an extra decimal point. Then the process for finding the d-correction involves 3 steps, whereas in Pub 249 we just look this up in one step from one table. Many mariners practicing cel nav prefer the 249 solution as it is a bit faster and they do not mind losing a bit of precision in the process, rarely more than 1 nmi in fix accuracy.

However, the US Navy and USCG, as well as other mariners striving for optimum accuracy from a tables solution choose to use Pub 229. With this in mind we have made a custom set of solutions to all 28 numerical examples in the book, providing all steps to the Pub 229 method. Those who choose to use Pub 229 can now supplement the text solutions with these data. It affects only what is in Box 5.

A sample of how the data are presented is shown below.

Star #10

tens d	30	-23.5	d upper
units d	4.2	-3.3	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-26.8	

5

tab Hc	52 °	26.7 '	d ±	-34.2	tab Z	28.8
d. corr.	Pub. 229	-26.8	' Dec min	47.0	Z corr. ±	-1.0
Hc	51 °	59.9 '			Z	27.8

Use of the tens and units corrections is explained in the Pub 229 instructions. We do not use the right hand column for double second difference. Refer to the Pub 229 instructions for the rare call for this more complex correction.

In each case we assume we are plotting from a standard Assumed Position, being a whole degree of Lat and using a whole degree of LHA. In that case, the only extra interpolation we need is for the declination minutes' effect on the azimuth angle, Z. This step has been tacked onto our standard Box 5, as shown above, and the solutions for each of these is listed in a separate table at the end of the four pages of Box 5 solutions.

Sun #1

tens d	50	-10.6	d upper
units d	5.9	-1.2	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-11.8	

5	tab Hc	27 °	59.1 °	d ±	-55.9	tab Z	149.8
	d. corr.	Pub. 229	-11.8	Dec min	12.7	Z corr. ±	+0.1
	Hc	27 °	47.3 °			Z	149.9

Sun #3

tens d	40	+30.5	d upper
units d	0.8	+0.6	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+31.1	

5	tab Hc	15 °	22.7 °	d ±	+40.8	tab Z	78.3
	d. corr.	Pub. 229	+31.1	Dec min	45.9	Z corr. ±	-0.5
	Hc	15 °	53.8 °			Z	77.8

Sun #5

tens d	40	+22.9	d upper
units d	7.6	+4.4	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+27.3	

5	tab Hc	54 °	01.2 °	d ±	+47.6	tab Z	126.4
	d. corr.	Pub. 229	+27.3	Dec min	34.4	Z corr. ±	-0.6
	Hc	54 °	28.5 °			Z	125.8

Sun #7

tens d	50	-44.1	d upper
units d	9.5	-8.4	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-52.5	

5	tab Hc	32 °	25.2 °	d ±	-59.5	tab Z	169.6
	d. corr.	Pub. 229	-52.5	Dec min	52.9	Z corr. ±	+0.1
	Hc	31 °	32.7 °			Z	169.7

Sun #2

tens d	50	+18.2	d upper
units d	1.7	+0.6	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+18.8	

5	tab Hc	58 °	13.4 °	d ±	+51.7	tab Z	137.7
	d. corr.	Pub. 229	+18.8	Dec min	21.9	Z corr. ±	-0.3
	Hc	58 °	32.2 °			Z	137.4

Sun #4

tens d	40	+24.4	d upper
units d	7.6	+4.6	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+29.0	

5	tab Hc	54 °	01.2 °	d ±	+47.6	tab Z	126.4
	d. corr.	Pub. 229	+29.0	Dec min	36.6	Z corr. ±	-0.6
	Hc	54 °	30.2 °			Z	125.8

Sun #6

tens d	50	-41.9	d upper
units d	2.3	-1.9	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-43.8	

5	tab Hc	22 °	30.5 °	d ±	-52.3	tab Z	137.7
	d. corr.	Pub. 229	-43.8	Dec min	50.3	Z corr. ±	-0.3
	Hc	21 °	46.7 °			Z	137.4

Sun #8

tens d	40	+15.9	d upper
units d	6.3	+2.5	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+18.4	

5	tab Hc	52 °	16.4 °	d ±	+46.3	tab Z	122.7
	d. corr.	Pub. 229	+18.4	Dec min	23.9	Z corr. ±	-0.4
	Hc	52 °	34.8 °			Z	122.3

Sun #9

tens d	10	+0.4	d upper
units d	3.1	+0.1	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+0.5	

5	tab Hc	49 °	42.6	'	d ±	+13.1	tab Z	84.9
	d. corr.	Pub. 229	+0.5	'	Dec min	02.3	Z corr. ±	-0.1
	Hc	49 °	43.1	'			Z	84.8

Star #2

tens d	50	+14.9	d upper
units d	0.0	+0.0	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+14.9	

5	tab Hc	56 °	44.2	'	d ±	+50.0	tab Z	133.2
	d. corr.	Pub. 229	+14.9	'	Dec min	17.9	Z corr. ±	-0.3
	Hc	56 °	59.1	'			Z	132.9

Star #4

tens d	50	-19.2	d upper
units d	9.9	-3.8	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-23.0	

5	tab Hc	18 °	51.2	'	d ±	-59.9	tab Z	175.3
	d. corr.	Pub. 229	-23.0	'	Dec min	23.0	Z corr. ±	-0.0
	Hc	18 °	28.2	'			Z	175.3

Star #6

tens d	40	+2.3	d upper
units d	7.4	+0.4	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+2.7	

5	tab Hc	43 °	11.9	'	d ±	+47.4	tab Z	122.4
	d. corr.	Pub. 229	+2.7	'	Dec min	03.5	Z corr. ±	-0.1
	Hc	43 °	14.6	'			Z	122.3

Star #1

tens d	40	+32.6	d upper
units d	6.3	+5.1	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+37.7	

5	tab Hc	35 °	10.0	'	d ±	+46.3	tab Z	117.6
	d. corr.	Pub. 229	+37.7	'	Dec min	48.9	Z corr. ±	-0.6
	Hc	35 °	47.7	'			Z	117.0

Star #3

tens d	40	+32.6	d upper
units d	4.4	+3.6	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+36.2	

5	tab Hc	30 °	00.2	'	d ±	+44.4	tab Z	110.5
	d. corr.	Pub. 229	+36.2	'	Dec min	48.9	Z corr. ±	-0.7
	Hc	30 °	36.4	'			Z	109.8

Star #5

tens d	40	+11.9	d upper
units d	5.6	+1.7	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+13.6	

5	tab Hc	51 °	04.0	'	d ±	+45.6	tab Z	120.3
	d. corr.	Pub. 229	+13.6	'	Dec min	17.9	Z corr. ±	-0.3
	Hc	51 °	17.6	'			Z	120.0

Star #7

tens d	30	+10.9	d upper
units d	9.8	+3.6	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+14.5	

5	tab Hc	19 °	27.1	'	d ±	+39.8	tab Z	76.5
	d. corr.	Pub. 229	+14.5	'	Dec min	21.8	Z corr. ±	-0.3
	Hc	19 °	41.6	'			Z	76.2

Star #8

tens d	40	+27.5	d upper
units d	1.7	+1.2	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+28.7	

5	tab Hc	10 °	32.8	d ±	+41.7	tab Z	77.9
	d. corr.	Pub. 229	+28.7	Dec min	41.2	Z corr. ±	-0.5
	Hc	11 °	01.5			Z	77.4

Star #10

tens d	30	-23.5	d upper
units d	4.2	-3.3	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-26.8	

5	tab Hc	52 °	26.7	d ±	-34.2	tab Z	28.8
	d. corr.	Pub. 229	-26.8	Dec min	47.0	Z corr. ±	-1.0
	Hc	51 °	59.9			Z	27.8

Moon #2

tens d	50	+40.2	d upper
units d	7.0	+5.6	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+45.8	

5	tab Hc	50 °	29.4	d ±	+57.0	tab Z	154.6
	d. corr.	Pub. 229	+45.8	Dec min	48.2	Z corr. ±	-0.4
	Hc	51 °	15.2			Z	154.2

Moon #4

tens d	50	-31.8	d upper
units d	9.9	-6.3	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-38.1	

5	tab Hc	25 °	53.8	d ±	-59.9	tab Z	175.8
	d. corr.	Pub. 229	-38.1	Dec min	38.2	Z corr. ±	+0.1
	Hc	25 °	15.7			Z	175.9

Star #9

tens d	40	+11.8	d upper
units d	2.1	+0.6	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+12.4	

5	tab Hc	09 °	13.5	d ±	+42.1	tab Z	72.3
	d. corr.	Pub. 229	+12.4	Dec min	17.7	Z corr. ±	-0.2
	Hc	09 °	25.9			Z	72.1

Moon #1

tens d	40	+39.9	d upper
units d	6.7	+6.7	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+46.6	

5	tab Hc	41 °	59.5	d ±	+46.7	tab Z	120.3
	d. corr.	Pub. 229	+46.6	Dec min	59.9	Z corr. ±	-0.9
	Hc	42 °	46.1			Z	119.4

Moon #3

tens d	50	+28.4	d upper
units d	4.3	+2.4	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+30.8	

5	tab Hc	51 °	07.4	d ±	+54.3	tab Z	144.1
	d. corr.	Pub. 229	+30.8	Dec min	34.1	Z corr. ±	-0.4
	Hc	51 °	38.2			Z	143.7

Moon #5

tens d	40	+0.1	d upper
units d	7.9	+0.0	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+0.1	

5	tab Hc	69 °	46.3	d ±	+47.9	tab Z	140.0
	d. corr.	Pub. 229	+0.1	Dec min	00.1	Z corr. ±	-0.0
	Hc	69 °	46.4			Z	140.0

Planet #1

tens d	40	+8.7	d upper
units d	0.8	+0.2	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+8.9	

5	tab Hc	15 °	22.2	'	d ±	+40.8	tab Z	71.2
	d. corr.	Pub. 229	+8.9	'	Dec min	13.0	Z corr. ±	-0.2
	Hc	15 °	31.1	'			Z	71.0

Planet #3

tens d	50	-24.3	d upper
units d	4.8	-2.3	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	-26.6	

5	tab Hc	32 °	45.7	'	d ±	-54.8	tab Z	145.0
	d. corr.	Pub. 229	-26.6	'	Dec min	29.1	Z corr. ±	+0.2
	Hc	32 °	19.1	'			Z	145.2

Planet #2

tens d	50	+37.3	d upper
units d	7.8	+5.8	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+43.1	

5	tab Hc	61 °	44.3	'	d ±	+57.8	tab Z	159.6
	d. corr.	Pub. 229	+43.1	'	Dec min	44.7	Z corr. ±	-0.4
	Hc	62 °	27.4	'			Z	159.2

Planet #4

tens d	30	+11.0	d upper
units d	0.1	+0.0	d lower
dsd corr.	+		dsd ←
d. corr.	Pub. 229	+11.0	

5	tab Hc	39 °	24.0	'	d ±	+30.1	tab Z	100.3
	d. corr.	Pub. 229	+11.0	'	Dec min	22.0	Z corr. ±	-0.4
	Hc	39 °	35.0	'			Z	99.9

Pub 229 Interpolation of Z for declination minutes (dec inc)							
Sight	tab Z (dec)	tab Z (dec+1)	diff	dec inc	(dec inc/60)	(dec inc/60) * diff	Corrected Z
Sun 1	149.8	150.2	0.4	12.7	0.2	0.1	149.9
Sun 2	137.7	136.8	-0.9	21.9	0.4	-0.3	137.4
Sun 3	078.3	077.6	-0.7	45.7	0.8	-0.5	077.8
Sun 4	126.4	125.4	-1.0	36.6	0.6	-0.6	125.8
Sun 5	126.4	125.4	-1.0	34.4	0.6	-0.6	125.8
Sun 6	137.1	137.6	0.5	50.3	0.8	0.4	137.5
Sun 7	169.6	169.7	0.1	52.9	0.9	0.1	169.7
Sun 8	122.7	121.6	-1.1	23.9	0.4	-0.4	122.3
Sun 9	084.9	083.4	-1.5	2.3	0.0	-0.1	084.8
Star 1	117.6	116.9	-0.7	48.9	0.8	-0.6	117.0
Star 2	133.2	132.2	-1.0	17.9	0.3	-0.3	132.9
Star 3	110.5	109.7	-0.8	48.9	0.8	-0.7	109.8
Star 4	175.3	175.3	0.0	23.0	0.4	0.0	175.3
Star 5	120.3	119.3	-1.0	17.9	0.3	-0.3	120.0
Star 6	122.4	121.5	-0.9	3.5	0.1	-0.1	122.3
Star 7	076.5	075.7	-0.8	21.8	0.4	-0.3	076.2
Star 8	077.9	077.1	-0.8	41.2	0.7	-0.5	077.4
Star 9	072.3	071.6	-0.7	17.7	0.3	-0.2	072.1
Star 10	028.8	027.5	-1.3	47.0	0.8	-1.0	027.8
Planet 1	071.2	070.5	-0.7	13.0	0.2	-0.2	071.0
Planet 2	159.6	159.0	-0.6	44.7	0.7	-0.4	159.2
Planet 3	145.0	145.5	0.5	29.1	0.5	0.2	145.2
Planet 4	100.3	099.2	-1.1	22.0	0.4	-0.4	099.9
Moon 1	120.3	119.4	-0.9	59.9	1.0	-0.9	119.4
Moon 2	154.6	154.1	-0.5	48.2	0.8	-0.4	154.2
Moon 3	144.1	143.4	-0.7	34.1	0.6	-0.4	143.7
Moon 4	175.8	175.9	0.1	38.2	0.6	0.1	175.9
Moon 5	140.0	138.2	-1.8	0.1	0.0	0.0	140.0

33°, 327° L.H.A. LATITUDE SAME

Dec.	45°				46°				47°			
	Hc	d	Z		Hc	d	Z		Hc	d	Z	
15	49 05.9	+ 48.3	126.5		48 29.8	+ 49.1	127.4		47 52.9	+ 49.8	128.3	
16	49 54.2	+ 47.9	125.6		49 18.9	+ 48.6	126.6		48 42.7	+ 49.4	127.5	
17	50 42.1	+ 47.4	124.7		50 07.5	+ 48.2	125.7		49 32.1	+ 49.0	126.6	
18	51 29.5	+ 46.9	123.7		50 55.7	+ 47.8	124.7		50 21.1	+ 48.6	125.7	
19	52 16.4	+ 46.3	122.7		51 43.5	+ 47.2	123.8		51 09.7	+ 48.1	124.8	
20	53 02.7	+ 45.8	121.6		52 30.7	+ 46.8	122.8		51 57.8	+ 47.6	123.8	
21	53 48.5	+ 45.2	120.6		53 17.5	+ 46.1	121.7		52 45.4	+ 47.1	122.8	

