Using the Modified Martelli Tables

2014 January 13 Monday
Assumed Position (GPS) N 35º 19.4′   W 119º 05.5′
IC -0.3′
Mirror artificial horizon (i.e. no dip corr'n)

Observations

Body	Time(Z)	Hs	IC	Ha	Refr	Ho
Capella	02:47:44	110º 47.0′	-0.3′	55º 23.4′	-0.7′	55º 22.7′
Deneb	02:49:40	54º 30.4′	-0.3′	27º 15.1′	-1.9′	27º 13.2′
Diphda	02:51:11	63º 23.2′	-0.3′	31º 41.5′	-1.6′	31º 39.9′

Almanac Data

Body	GHA	Dec
Capella	75º 00.3′	N 46º 00.6′
Deneb	204º 27.5′	N 45º 20.1′
Diphda	144º 14.3′	S 17º 54.7′

A time-sight reduces an (optimally East or West azimuthal) observation to the longitude of the observer. As such, we require only one of these bodies, but we will reduce all three observations and see how well we do.

We require four datums, all *rounded to the nearest minute*:

1. An (accurate) latitude of the observer
2. The declination of the observed body
3. The Greenwich Hour Angle (GHA) of the body
4. The corrected observed altitude (Ho) of the body

The rules are:

1. Put the down the larger of the latitude of the observer or the declination of the body.
2. If **Same Name**, **subtract** the smaller from the larger. If **Contrary Name**, **add** them.
3. Put the observed Ho below the difference/sum.

Capella

The declination of Capella is larger than the latitude, so we write the declination first, and then the latitude. The declination has the same name as the latitude (both are North), so we find their *difference* and place it beneath the latitude. The altitude of the observation (Ho) is entered on the line below the difference. Note that we leave room to the left for our work.

Dec	46 01
Lat	35 19
Diff	10 42
Ho	55 23

Using Table I, `Latitude and Declination`, enter to the right of the declination and latitude values their table values.

Dec	46 01	**3416**	Table I
Lat	35 19	**4117**	
Diff	10 42		
Ho	55 23		

Now enter Table II, `Sum or Difference`, with the difference value and extract a time in minutes and seconds (to the nearest tenth of a second). I find it reduces clutter to put this entry to the left of the Diff:

	Dec	46 01	**3416**	
	Lat	35 19	**4117**	
19 42.6	Diff	10 42		Table II
	Ho	55 23		

Enter Table III, `Angle of Altitude`, with the Ho value, and again extract a time denoted in minutes and seconds:

	Dec	46 01	**3416**	
	Lat	35 19	**4117**	
19 42.6	Diff	10 42		
2 57.0	Ho	55 23		Table III

Add together the time values extracted from Tables II and III. Remember that *sixty seconds carries into the minutes column*:

	Dec	46 01	**3416**
	Lat	35 19	**4117**
19 42.6	Diff	10 42	
2 57.0	Ho	55 23	
22 39.6			

With the sum of the two times, enter Table IV, `Auxiliary Logarithm`, and put the respondent value beneath the logarithm for latitude (to the right of Diff). Take care to extract the leading digit, which is only printed every five entries in the table.

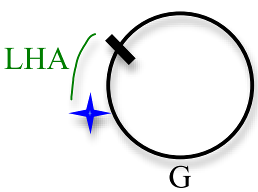
	Dec	46 01	**3416**	
	Lat	35 19	**4117**	
19 42.6	Diff	10 42	**1.1314**	Table IV
2 57.0	Ho	55 23	:	
22 39.6	------------------------------:			

Add the three logarithms:

	Dec	46 01	**3416**	
	Lat	35 19	**4117**	
19 42.6	Diff	10 42	**1.1314**	
2 57.0	Ho	55 23	**1.8847**	Add the three logarithms
22 39.6				

Enter Table V, `Local Hour Angle`, with the sum of the logarithms and extract the local hour angle:

	Dec	46 01	**3416**		
	Lat	35 19	**4117**		
19 42.6	Diff	10 42	**1.1314**		
2 57.0	Ho	55 23	**1.8847**	**44º 05'**	Local Hour Angle
22 39.6					



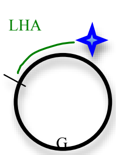
Rather than use rules on how to combine the LHA with the GHA of the body to arrive at the longitude of the observer, I use a small diagram. It is a circle with G at the bottom, denoting Greenwich. To the left of Greenwich are western longitudes and to the right are the eastern longitudes. Per convention, GHA is measured clockwise (0º at G) around the circle (360º is back at G). On this circle, mark the GHA of the body, and the longitude of the assumed position of the observer. The local hour angle will be the arc of the circle between the observer and the body. From the picture it is evident that we should add the LHA to the GHA to obtain the (western) longitude:

44º 05'	Local Hour Angle
75º 00'	Greenwich Hour Angle
W 119º 05'	Longitude of the observer

Here are the workings for the other two observations:

`Deneb`

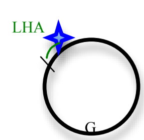
	Dec	45 20	**3469**	
	Lat	35 19	**4117**	
19 44.8	Diff	10 01	**0.6123**	
9 02.6	Ho	27 13	**1.3709**	
28 47.4			**85º 23'**	LHA



204º 28'
-85º 23'
W 119º 05'

`Diphda`

	Lat	35 19	**4117**	
	Dec	17 55	**4784**	
19 44.8	Sum	53 14	**14676**	
7 55.0	Ho	31 40	**2.3577**	
21 13.6			**25º 09'**	LHA



144º 14'
- 25º 09'
W 119º 05'