Procedure- plotting a Line of Position

Plotting a Line of Position

In this step of Plotting a Line of Position refer to the UPS at the end of this document.
If you can't clearly see the picture click here to get the PDF- UPS LOP plot.pdf.

Plotting tools needed

Universal Plotting Sheet. Get one here- Universal Plotting Sheet
Dividers
Parallel rules
Pencil

Figures we're working with to plot an LOP

Ap λ= W 025° 57.5' (**57.5'** are the minutes of Longitude derived from the GHA in the procedure *Complete Sun Sight Reduction Procedure- Ocean horizon* found at- TheNauticalAlmanac.com/Methods.html

Intercept= 0**°** 10**'** (*Away*)

Zn= 207**°**

DR. Latitude= N 27**°**

Label lines of Latitude

Label the lines of Latitude with a mid Latitude of N 27**°** as seen on the UPS at the end of this document.

Layout Longitude Lines on the UPS

The following steps refer to the UPS at the end of this document and notice the descriptive words designating the areas of the UPS being referred to. When in this explanation you read about, for example, "the compass rose" look on the UPS and find where the words "the compass rose" are located which will be close to the area of the UPS being discussed. Sometimes words and an arrow are used to point to the item be referred to.

The correct Longitude line must be draw on the UPS to establish the proper spacing of Latitude lines in relation to the lines of Longitude.

The spacing between lines of Latitude do not change on the UPS. The distance in nautical miles between whole degree parallels of Latitude is always 60 nm no matter where you are on earth.

The lines of Longitude exactly on the equator at 0**°** 00**'** are 60 nm apart. As you proceed any distance North or South of the Equator the lines of Longitude begin to converge until finally at the North, or South, Pole there is no distance between them.

In order to establish the correct relationship between lines of Latitude and Longitude on the UPS the lines of Longitude will have to be drawn in based on the DR. Latitude.

The UPS circle with the numerical degree marks is called "the compass rose"- for plotting purposes

the compass rose uses True North and not magnetic North as 0°. Using the middle graduated line of longitude as a vertical reference, place the parallel rules on the middle line of longitude and "walk" the parallel rules to the right so that the edge of parallel rules touch the outside of the compass rose at the 27 ° mark on the UPS (20 mark plus seven individual marks).

Draw a vertical line of Longitude through the outside of the compass rose 27° as seen on the UPS sheet. The line is drawn vertically between, and touches, the Latitude lines of N 27° and N 28°.

Using the middle graduated line of longitude as a vertical reference, place the parallel rules on the middle line of longitude and "walk" the parallel rules to the right so that the edge of parallel rules touch the outside of the compass rose at the 26° mark on the UPS (20 mark plus six individual marks).

Draw a vertical line of Longitude through the outside of the compass rose 26° as seen in the UPS. The line is drawn between, and touches, the Latitudes of N 26° and N 27°.

Notice that there is a small offset difference between the Longitude lines. This is a graphic illustration of the lines of Longitude getting closer the further North you proceed as you would see on a globe of the earth. The same graphic illustration of Longitude line convergence is true for the Southern hemisphere except that the Latitude figures would be reversed- S 26° would be at the top Latitude line of the UPS then S 27° and finally S 28° would be at the bottom of the UPS.

Setting the UPS Longitude scale

To set the proper spacing of Longitude minutes when using the UPS the scale in the lower right corner of the UPS is used. The Longitude minutes spacing scale is determined by Latitude which for this example is N 27°. Draw a horizontal line on the UPS Longitude scale between the 20 and 30 so that it approximates where 27° would be. Notice on the right side of UPS Longitude scale there are a series of five vertical lines. The distance between each of the lines represent 2 minutes of Longitude based on the Latitude being plotted, in this example it's N 27°. Notice that these lines converge the closer they are to 70° which shows how lines of Longitude get closer together the further North (or South) on a chart an area is shown.

There are 5 other curved vertical lines on the UPS Longitude scale. The space between each of these lines represents 10**'** (10 minutes) of Longitude. So, when you add up the horizontal distance from the far left side of the UPS longitude scale to the far right side of UPS longitude scale the result is 60' (60 minutes of arc) or 1° of Longitude.

Plot the Ap λ minutes of longitude

Using the UPS longitude scale and dividers measure **58'** minutes (57.5' rounded up) and set the dividers to that distance. The minutes figure was rounded up to make plotting easier as your pencil width will almost be as wide as 00.5' (minutes of Longitude on the scale being used). Remember that the minutes of Longitude are derived from the GHA minutes portion of the final GHA figure found in the GHA step above.

Using the dividers place one point of the dividers where N 27° intersects with W 025°. Place the other point of the dividers horizontally across the N 27° line of Latitude and make a tiny mark. This second point is the location of the Ap λ W 025° **58'** (remember- for ease of plotting the 57.5' was rounded up to 58').

Take your pencil and make a small mark at the 58' point.

Draw the Azimuth line

The azimuth line (Zn) to be drawn is 207**°** as calculated above in the Zn section**.**

Take the parallel rules and put one edge of the rules on the very center of the compass rose. Align the same edge so that it intersects 207° as seen on the UPS marked as “azimuth line”.

Without changing their angle, “walk” the parallel rules over so that one edge of the rules intersects the pencil point placed at the W 025° 58**'** Ap. λ and draw the azimuth line towards the direction of the 207° mark. Remember- don't change the angle of the parallel rules. You're just drawing a 207° line through the Ap. λ point placed at W 025° 58**'.** Draw the line a little longer in the opposite direction as in the next step you will be drawing the Intercept line *Away* from direction of the Sun.

If you want you can draw a circle at the end of the line near 207° to remind you of the direction of the Sun from your Assumed Position.

Mark the Intercept line location

The Intercept as calculated in the **Intercept** section above was 0**°** 10**'** (*Away*). “Away” means that the LOP (Line of Position) will be drawn away from the direction of the observed celestial body- the Sun.

Using the dividers and the vertical graduated latitude scale in the middle of the UPS, measure off and set the dividers to 10**'** (minutes). Put one point of the dividers on the 26° Latitude line and the other point on the 10**'** mark on the vertical Latitude scale in the middle of the UPS.

Using the dividers set to 10**'** put one point of the dividers on the 58**'** mark that's located at W 025° 58**'**. Put the other point of the dividers along the azimuth line in the opposite direction of 207° (away from the Sun) and mark a small point. Re-mark the new point using a pencil.

Draw the Intercept line- the LOP

The Intercept line is drawn 90**°** to the azimuth line**.**

Subtract 90° from 207° and get 117°.

Take the parallel rules and put one edge of the rules on the very center of the compass rose. Align the same edge so that it intersects 117° on the UPS. That's at the 110° mark plus 7° on the UPS.

Without changing their angle, “walk” the parallel rules up so that one edge of the rules intersects the pencil point placed at the 10**'** *Away* mark and draw the intercept line so that it's about 3 inches long (1-1/2” on either side of azimuth line).

Remember- don't change the angle of the parallel rules when you “walk” them.

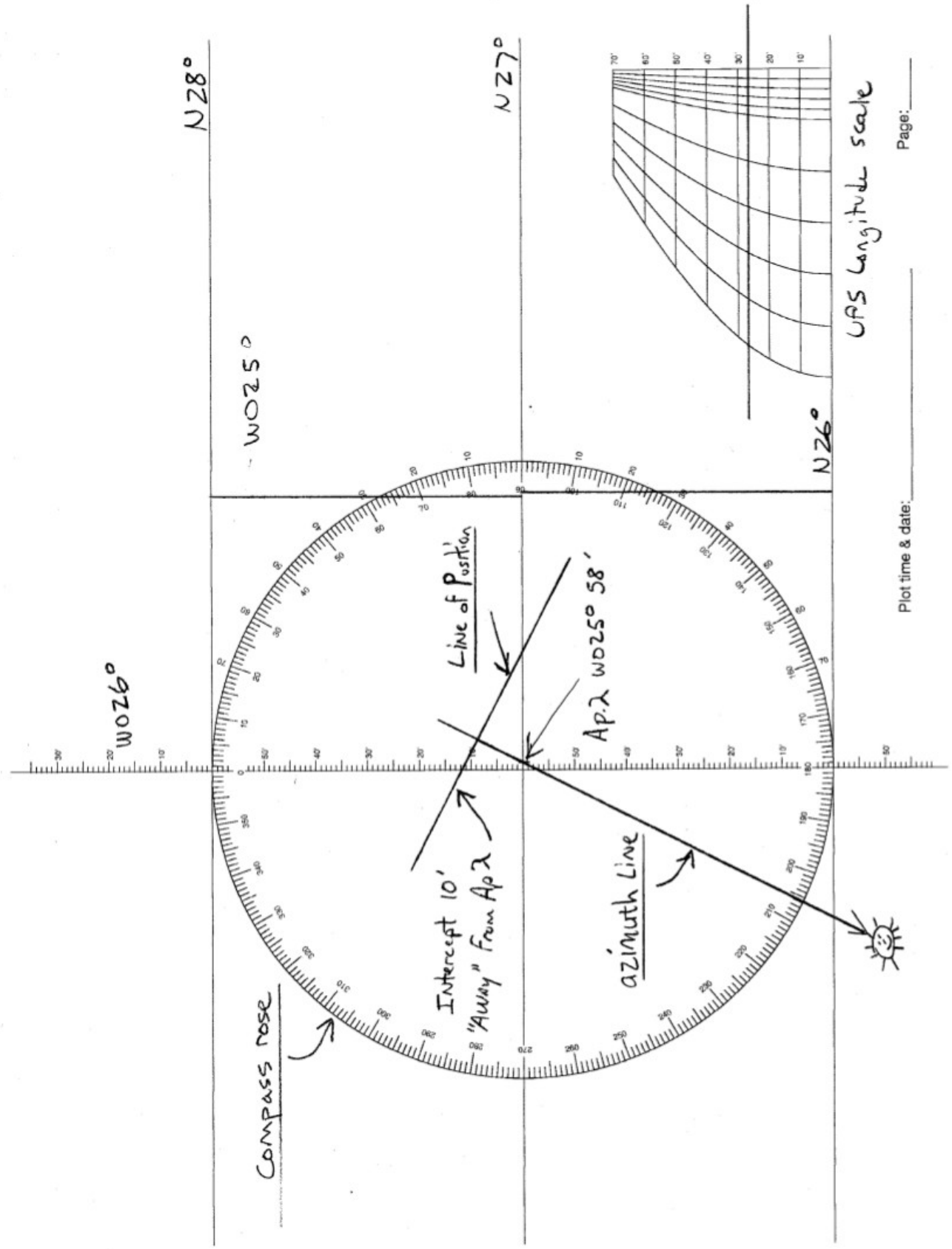
Conclusion

You're now finished performing a Sun sight reduction and plotting an LOP (Line of Position). If this had been and actual Sun sight reduction while you're sailing you would be located *somewhere* along the LOP that was just drawn.

If you then wanted to obtain a position “fix” then you must wait about 1 hour and take another observation of the Sun and perform another Sun sight reduction and plot the resulting LOP. If you're at sea, the first LOP would have to be advanced in the True direction (not magnetic) you have been traveling and the DR distance. Where the two LOPs intersect is the position “fix”- where you were at the time of the second Sun sight.

Fair winds....clear skies & following seas

TheNauticalAlmanac.com


N28°
W025°
N27°
N26°
W026°
GPS Longitude scale
Page:
Plot time & date:
Line of Position
Ap.λ W025° 58'
Intercept 10'
"Away" From Ap λ
Azimuth Line
Compass rose