EXPLANATION OF THE METHOD

Ogura's Altitude Table—Formula: Cosec H = sec N sec (K∼d)

Let the spherical triangle used in navigation and projected on the plane of the horizon be represented by Fig. 1. Let the parts of the triangle be designated as follows:

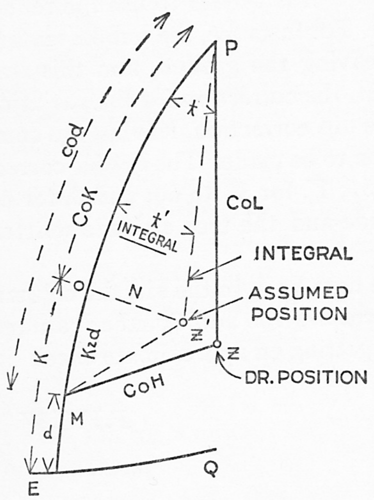

Fig. 1.

P	Pole
Z	Zenith of the observer. The azimuth (angle PZM) is also called Z.
M	Body observed
L	Latitude
d	Declination
t	Hour angle of body M
H	Altitude
EQ	Equinoctial
N	Perpendicular let fall from Z′ on PM. This is an auxiliary part.
O	Intersection of N with PM
K	Distance from O to the equinoctial. This is an auxiliary part introduced to facilitate the solution of the triangle. *K always takes the sign of L.*

In the right triangle PZO, we know the values of t and L. Table A gives for all integral values of t and L the corresponding values of A(=log sec N) and of K. The angle K is combined with d algebraically to get K∼d, and with K∼d as an argument, we find in Table B the value of B(=log sec (K∼d)). The sum of A and B is log cosec H, from which H is found by entering table B at the bottom. In order to avoid interpolation in Table A, an assumed position, Z′, is used such that both t and L will be integral degrees.

Rust's Modified Azimuth Diagram—Formula: sin *t* cos d = sin Z cos H

Referring to pages 40 and 44, the values of *t* are shown in left margin, of Z, in right margin. Both H and d are plotted on same curves and numbered alike. On the diagram the interpolations are made by sight, while in tables this is done mathematically. It is a great deal easier to interpolate on the diagram by sight than to do so in tables. Since both the tables and the diagram are based on the same conditions, viz., the apparent motion of the body across the sky, they both have the same weakness when the body crosses the meridian near the prime vertical.

For any desired accuracy of azimuth, it is only necessary to increase the scale of the diagram enough to accomplish the desired end. The scale of the azimuth diagram given in Rust's *Practical Tables* has been multiplied by 1.5 in the diagram. The complete diagram to full scale would necessitate the use of a folder to include it in a book, therefore, in order to include it in a book to the proper scale and in convenient form, it has been divided into two parts. In this way separate double

pages show the left and r
use the diagram on pag
The simplicity and
typical sight of the sun a
tion for all cases, only or

For the Altitude Differen

(1) Find the Greenw
(2) Apply to the G.
make the local hour ang
(3) Assume a latitu
(4) Enter Table A
and K. The H.A. is at t
90°, enter Table A at b
value from 180° to find
(5) Enter Table B
of the latitude, and the
when signs are unlike,
(6) Enter Table B
of altitude appearing a
(7) The difference b
the altitude difference
the assumed position t
when smaller. The li
tion and is laid off at r
Note: The tables
interpolation, for close

For the Azimuth:

(1) Enter left mar
(2) Then follow th
(3) Then follow th
(4) Then follow th

For Naming the Azim

(5) Give Z the na
body bears NW and
Naming the azim
three rules:
1. If the declinat
greater, the azimuth
2. If the declinat
name of the declinati
3. If the declinat
less than the latitude
mined by the method
The azimuth is e

pages show the left and right parts. A little practice will make it clear whether to use the diagram on page 40, or that on page 44.

The simplicity and neatness of the system will now be shown by working a typical sight of the sun and of a star. First we shall enumerate the steps in the solution for all cases, only one uniform method being used.

Method of Solution

For the Altitude Difference.

(1) Find the Greenwich hour angle (G.H.A.) in degrees.

(2) Apply to the G.H.A. an assumed longitude (nearest D.R. long.), which will make the local hour angle (L.H.A.) an integral number of degrees.

(3) Assume a latitude (integral degrees) nearest the D.R. latitude.

(4) Enter Table A with L.H.A. and with the assumed latitude and take out A and K. The H.A. is at the top, and L at left margin. If the L.H.A. is greater than 90°, enter Table A at bottom and take out A and 180° − K, and then subtract this value from 180° to find K. For example, if 180° − K = 78°, K = 180° − 78° = 102°.

(5) Enter Table B with K∼d and take out B. To find K∼d, give K the sign of the latitude, and then combine K and the declination algebraically, i.e., the sums when signs are unlike, and the difference when the signs are alike.

(6) Enter Table B with A+B and take out the computed altitude; the degrees of altitude appearing at the bottom and the minutes of altitude at the right margin.

(7) The difference between the computed (H_c) and the observed (H_o) altitudes is the altitude difference ($H_c \sim H_o = a$); the altitude difference, "a", is measured from the assumed position toward the body when the H_o is greater than H_c, and away, when smaller. The line of position is at the distance, "a", from the assumed position and is laid off at right angles to the bearing of the body.

Note: The tables give an accuracy of solution to within 1′ of altitude, without interpolation, for closer results interpolate in Table B.

For the Azimuth:

(1) Enter left margin with H.A., or with 180°–H.A., if H.A. is over 90°.
(2) Then follow the horizontal line to the declination curve.
(3) Then follow the vertical line to the altitude curve.
(4) Then follow the horizontal line to right margin and pick off azimuth (Z).

For Naming the Azimuth:

(5) Give Z the name of the quadrant in which the body is found; for example, if body bears NW and Z is 80, Z = N80W, and Zn = 280.

Naming the azimuth North or South is determined by one of the following three rules:

1. If the declination and latitude have the same name but the declination is greater, the azimuth takes the name of the declination.

2. If the declination and latitude have contrary names the azimuth takes the name of the declination.

3. If the declination and latitude have the same name but the declination is less than the latitude, the diagram on page 40 must be entered and the name determined by the method explained there.

The azimuth is east when L.H.A. is east, and west when L.H.A. is west.