Horizon Angle and Its Relation To the Altitude of the Observer

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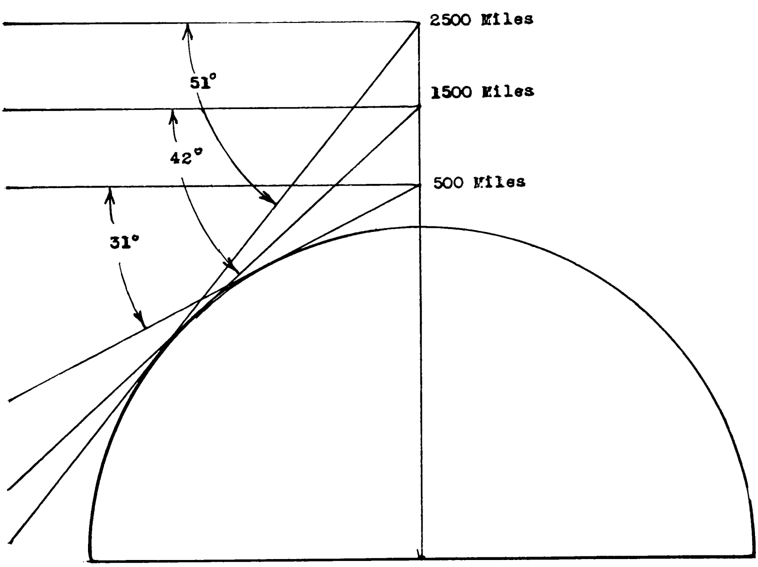
The writer received a letter from Mr. B. V. Myrick, USAACR, Flight Instructor at Vernon, Texas, asking for information concerning the value of the Horizon Angle as seen from different altitudes above the surface of the earth. The term "Horizon Angle," as used, is the angle made by a vertical line and a line drawn from the eye of the ob-

FIGURE 1

THE ANGLE OF THE HORIZON FOR HIGH ALTITUDES

(This problem is solved by construction)



Horizon angle for altitude 2500 miles = 90° + 51° = 141°
Horizon angle for altitude 1500 miles = 90° + 42° = 132°
Horizon angle for altitude 500 miles = 90° + 31° = 121°

server tangent to the horizon. In this discussion, the earth's surface is assumed to be level and to have the curvature of the sea.

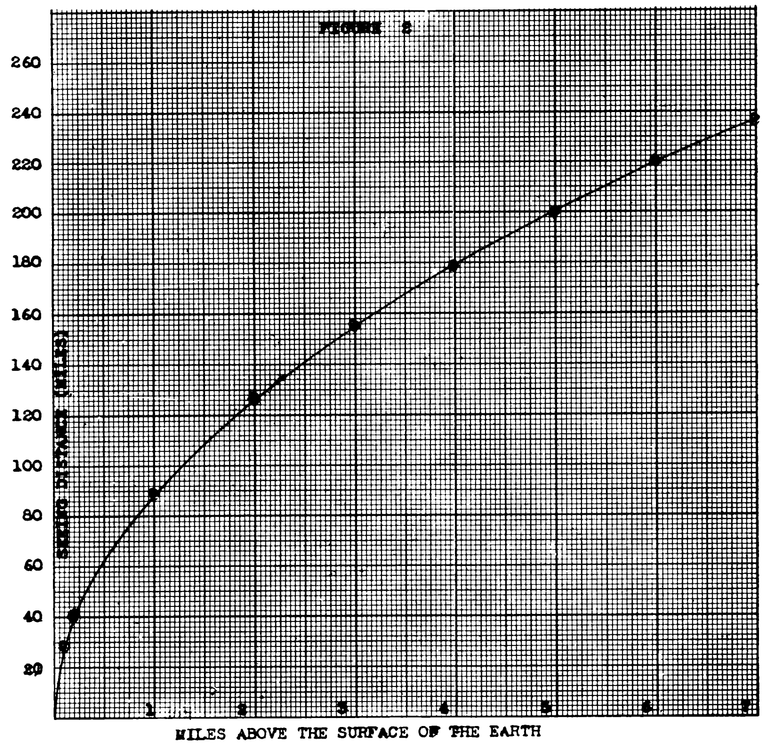
TABLE I

THE ANGLE OF THE HORIZON FOR LOW ALTITUDES

Altitude in miles	Angle of the Horizon	Apparent position of Sun at sunrise
.0	90° + 0' = 90°.0'	Sealevel Horizon
.1	90° + 12' = 90° 12'	Sealevel Horizon
.2.	90° + 18' = 90° 18'	Sealevel Horizon
1.	90° + 38' = 90° 38'	Sealevel Horizon
2.	90° + 54' = 90° 54'	Sealevel Horizon
3.	90° + 66' = 91° 6'	Sealevel Horizon
4.	90° + 77' = 91° 17'	Sealevel Horizon
5.	90° + 86' = 91° 26'	Sealevel Horizon
6.	90° + 94' = 91° 34'	Sealevel Horizon
7.	90° + 101' = 91° 41'	Sealevel Horizon
8.	90° + 108' = 91° 48'	Sealevel Horizon

After preparing the tables and figures for Mr. Myrick it occurred to me that this information might be useful to other flight instructors; hence these data are being published and sent to those who may be interested. Copies may be obtained by writing to the author.

In Table I, the Horizon Angle for low altitudes is given; also the position of the sun at the time of sunrise, at the surface of the earth, as seen from different low altitudes. From this table it will be seen that for the altitude at



which airplanes fly, the horizon angle never becomes much greater than 90 degrees. In column 3 of Table I it will be noted that when the sun is rising at sea-level it will have a greater altitude for points above the surface of the earth, reaching a value of 91° 48′ when the plane is at an altitude of 8 miles. In obtaining these data the following equation was used:

Horizon Angle is equal to 90° plus the angle that has a tangent equal to altitude divided by the Seeing Distance. (*See* Fig. 2.)

Figure 1 shows the horizon angle for some high altitudes. The solutions were made by construction.

In Figure 2, the seeing distance and its relation to altitude is given by a curve. The equation used in finding the points on the curve was as follows:

(Altitude) $\times$ (Diameter of the earth) $=$ (Seeing Distance)^2. This equation will give good accuracy for altitudes no greater than those used in plotting the curve. It is not accurate for high altitudes. The "Seeing Distance" (as the term is used here) is the distance at which an object flat upon the surface of the earth may be seen, when the atmosphere is clear.