Basic Geodesy

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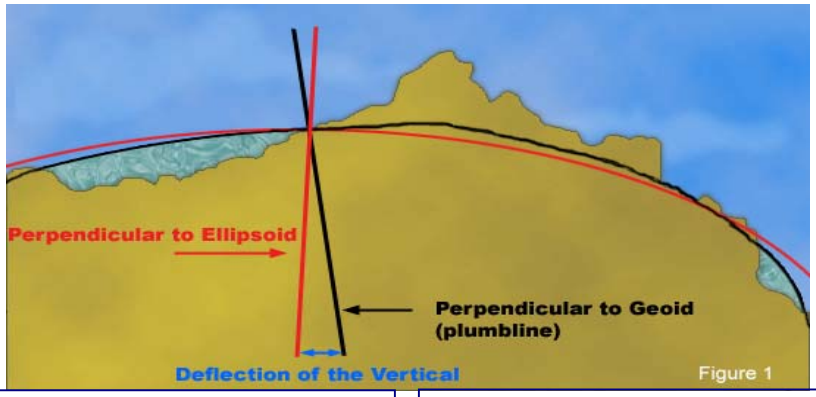

Figure 1

Gravity

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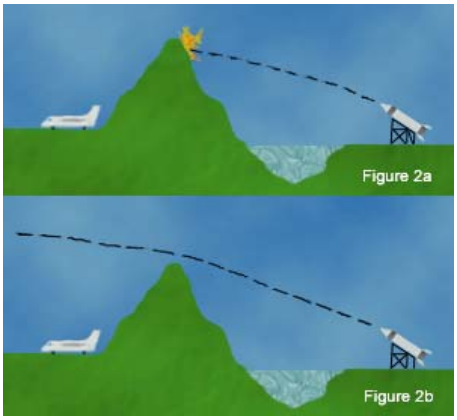
The gravitational pull of the earth has significant effects upon surveying, mapping, and geodetic measurements. When viewing Figure 1 above, we should remember that the ellipsoid is the mathematical model of the shape of the earth and that the geoid is the surface along which gravity potential is equal and to which the direction of gravity is always perpendicular.

When surveying, the plumb bob is aligned perpendicular to the geoid. However, the geodetic normal line for the same survey station usually does not coincide with the plumb bob direction resulting in an angular separation that is referred to in geodesy as the "deflection of the vertical (DOV)". The components of the DOV are used to improve the accuracy of military inertial navigation systems. Since mapping and charting is produced on the ellipsoid, the survey data must be *reduced* to the ellipsoid.

The importance of accurate gravity data can be seen in Figures 2a and 2b. In these diagrams we are assuming that a long-range rocket is being fired in an attempt to destroy an airfield. If we assume that the gravitational pull of the earth is the same at the rocket launch site, as well as along the flight path and at the airfield, but it is actually stronger along the flight path, the rocket could hit the mountain (Figure 2a).

However, if the gravitational pull is less in the mountainous region, the rocket could overshoot the target (Figure 2b).

The Geospatial Sciences Division in the Targeting and Transnational Issues Office in NGA are responsible for collecting, processing, evaluating, and generating products from gravity data for DoD and the IC community. An Earth Gravity Model computed by NGA, NASA, and academic institutions using 23 million points in the Geospatial Sciences gravity database represents the gravity field of the earth. The current model is Earth Gravity Model 1996 (EGM 96) and is constructed on a 15-minute by 15-minute worldwide grid.



"Ideal" Maps

The next article will discuss the problems involved in taking an ellipsoidal shaped earth and mapping it on a flat sheet of paper and the concept of an "ideal" map.