# GOALS OF GEODESY

**It impossible to categorize goals of geodesy exclusively, but consider:**

**<u>EARTH'S SIZE & SHAPE:</u> It is not practical (though the boundary of this limitation is changing) to define mathematically every point on/near the surface of the earth. Instead, spatial location is referenced to a mathematical model which best approximates earth's size and shape. The model most often used is the *ellipsoid* formed by rotating an ellipse about its minor axis. (In the past such a figure has been referred to as a *spheroid* and some use the terms interchangeably. Modern practice needs to be careful about possible confusion of the two.) The ellipse major axis lies in earth's equatorial plane while the minor axis is coincident with earth's spin axis. An ellipsoid can be defined by:**

$a$ = **semi-major axis of ellipse & $b$ = semi-minor axis of ellipse**
**& $1/f$ = reciprocal flattening**
**& $e^2$ = ellipse eccentricity squared**

**Another approximation of the earth's size and shape is given by the *geoid* which is loosely defined as mean sea level. A precise definition of the geoid includes physical geodesy and the concept of an equipotential surface. Generally, the geoid is the surface formed by the ocean surface in equilibrium and the level to which water would rise in a transcontinental canal. Due to variations in gravity, the geoid does not follow the ellipsoid exactly, but deviates from it by up to 100 meters on a global scale. The difference between the ellipsoid and geoid is known as *geoid height (or geoid undulation)* and its precise determination remains an object of ongoing scientific research.**

**<u>SPATIAL REFERENCING:</u> A second goal of geodesy is to describe the location of points on or near the earth's surface with geodetic coordinates. *Latitude* is the angular distance north or south of the equator, *longitude* is the angular distance east (or west) from the Greenwich Meridian and *orthometric height or elevation* is the distance above/below mean sea level. (With the advent of global positioning system (GPS) surveying, this concept needs to be revisited.) Networks of monumented control points, both horizontal & vertical, have been established in many/most parts of the world and provide the basis of working "from the whole to the part" for many surveying/engineering/mapping functions. Prior to the space age, geodetic surveying activities were confined to the continental land masses, but now spatial referencing is conducted on a global scale and the traditional horizontal/vertical control networks are being replaced with integrated global three-dimensional reference networks.**

**<u>GRAVITY FIELD:</u> A third goal of geodesy is to determine the earth's external gravity field. Isaac Newton, Christian Huygens and others in the middle 1600's recognized the earth's shape is influenced by gravity. Since then much scientific research has been devoted to quantifying and understanding the earth's geophysical attributes.**

 