Specifying the geodetic datum in LEO_07.

Glen Gagnon
Kansas Geological Survey
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In addition to selecting the unit of measure, the user must specify the geodetic reference datum when converting latitude and longitude (lat/lon) coordinate pairs to PLSS values. Many GPS receivers have menu options for selecting these parameters and the user should become familiar with them. USGS topographic maps use the North American Datum 1927 (NAD27) and North American Datum 1983 (NAD83). The World Geodetic System 1984 (WGS84) datum works well for navigation and is frequently the default menu option for GPS devices.

To help understand the concept of a reference datum consider the following analogy.

If it takes you 45 minutes to grocery shop, the “quantity” is 45 and the “unit of measure” is minutes. The question could be asked; how was the time determined? Did you use a "Sun Dial", an "Hour Glass", a "Wrist Watch" or perhaps an "Atomic Clock?" The method used would represent the reference frame for measuring the time elapsed, as each method would produce a different degree of accuracy and precision.

The geodetic datum identifies the reference frame (mathematical algorithm) used to derive the lat/lon coordinates. It is necessary to specify the datum when navigating to a location or spotting a location on a map. For LEO_07 conversions, NAD83 and WGS84 are virtually synonymous. If a user has WGS84 coordinates, selecting the NAD83 option will work just fine. However the LEO user must be careful to avoid selecting NAD27 when NAD83 is called for and vice versa. Using the wrong datum can result in errors upwards of 60 meters (~200 feet).

A datum is based on a mathematical approximation of the shape of the earth called an ellipsoid. Over time, the ellipsoid algorithms have been refined to produce better models of the earth allowing for better mapping capabilities and more accurate navigation information. The NAD27 datum uses an ellipsoid called "Clarke 1866" which was derived from surface location measurements. Both NAD83 and WGS84 are more sophisticated models based on the earth’s center of mass. Additionally, the NAD83 algorithm is based on a network of control monuments located on the North American tectonic plate whereas the WGS84 model was developed with control monuments throughout the world. Both (NAD83 and WGS84) initially used the same ellipsoid and produced the same results. Over time, the models have been refined and now differ slightly. The initial WGS84 and NAD83 models used a semi-polar axis calculation of 6365752.314140 meters in length. Later WGS84 was refined to have a semi-polar length of 6365752.314245 meters. This change results in calculation differences that are insignificant when considering the degree of accuracy (24 meters or ~ 80 feet) of the LEO_07 conversion routines, the accuracy of consumer grade GPS receivers, and the precision associated with the tasks of spotting oil wells on a topographic map.