

Basic Geodesy

Article 17

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Military Grid Reference System (MGRS)

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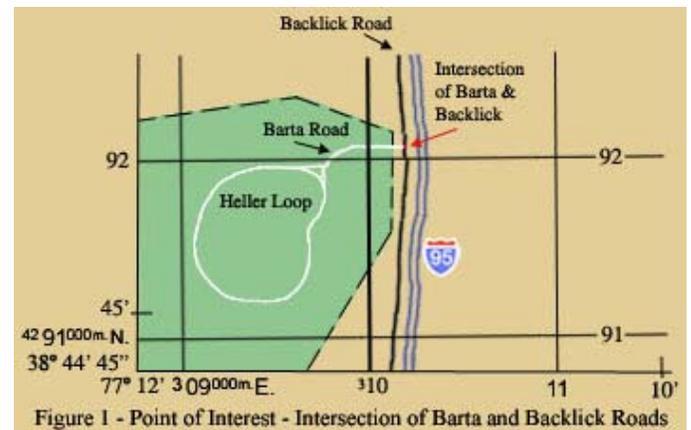
One question that we often receive from our customers is; "What is the difference between a MGRS coordinate and a UTM coordinate?" The simple answer is that a MGRS (Military Grid Reference System) coordinate is a specific way to provide a UTM (Universal Transverse Mercator) grid value. However, MGRS can also be used as a specific method for providing UPS (Universal Polar Stereographic) coordinates while UTM grid values are not used in the polar regions.

Figure 1 will be used to demonstrate examples of a UTM grid value and a MGRS value for the same point. (Intersection of Barta and Backlick Roads in Springfield, VA - It may be helpful to review basic geodesy articles 15 & 16 at the archive links listed in this article. The NGANet link is provided on the last page.) To determine the UTM grid values, we would use a scale to derive the following coordinate:

[310,200 m. E.](#), [4,292,080 m. N.](#), [UTM Zone number 18](#), [Northern Hemisphere](#). (Please note that this "map" is not accurate. It is intended only for illustrative purposes and the grid values for this location may be in error by over 200 meters. It is not at true scale, but is intended to represent a 1:50K map. UTM coordinates can be interpolated to the nearest 10 meters on 1:50K maps. Also, it is important to know that, for this example, the datum is World Geodetic System 1984 (WGS 84.) The MGRS value for this point is: [18SUH10209208](#) This article will provide more details on how this MGRS value was derived, but first, we will discuss grid labeling on maps.

The first Northing grid line nearest the SW geographic corner of the sheet is labeled 4,291,000m. N., while the first Easting grid line is labeled as 309,000m. E. These values are written with some of the numbers and the

meter abbreviation in superscript. The second Northing line has only a 92 value, even though its complete value is 4,292,000m. N. The second Easting grid line is labeled as 310 (superscript 3), and its complete value is 310,000 m. E. This is due to standards and specifications for 50,000 scale topographic maps require every even 10,000 meter grid value to be labeled this way.



MGRS value

The diagram in Figure 2 (Page 2) shows how the first portion of the MGRS coordinate, known as the Grid Zone Designator (GZD), is determined. In addition to the UTM grid zone, there is an additional letter representing the band (Note the letters I and O are avoided to eliminate possible confusion with the numbers 1 and 0.) The UTM zone limits the area to a 6 degree wide zone from 84 degrees North to 80 degrees South. Adding the band letter further limits this to an 8 degree by 6 degree area. The GZD for our area of interest is: [18S](#)

This 8 degree by 6 degree area is further subdivided into 100,000 meter grid squares that are identified by two letters. This can be seen in Figure 3 on Page 3.

Continued next page

MGRS value (continued from Page 1)

The two letter value portion of the MGRS is known as the 100,000 meter Grid Square Identifier and for our area of interest is: **UH** When this is combined with the GZD (**18S**), our value is now: **18SUH** This identifies the 100,000 meter grid square block that our point of interest falls within.

The next portion of our MGRS coordinate is the numerical portion of the UTM grid values. The number of digits in this portion of the coordinate defines the level of detail in the coordinate. A complete MGRS value can represent the SW corner of either a 10,000 meter grid square box, a 1,000 meter grid square box, a 100 meter grid square box, a 10 meter grid square box, or a 1 meter grid square box. Reviewing our complete UTM grid value determination for our point of interest:

310,200 m. E., 4,292,080 m. N, UTM Zone number 18, Northern Hemisphere.

and our MGRS value so far: **18SUH**, we can now begin adding the numbers representing the Easting and Northing grid values. Keep in mind that the 100K Grid Zone Designator (UH) already identifies the coordinate down to the 100,000 grid square level. Therefore, we can remove the first number(s) representing the 100,000 place from the Easting and the Northing (the number 3 from the 310,000 m. E. value and the 42 from the 4,292,000 m. N. value) and put the 1 from the Easting and the 9 from the Northing at the end of what we already have (NOTE: The Easting value is always listed first):

18SUH19 (SW corner of 10,000 meter grid square containing our point of interest)

If we desire, we could keep taking more digits from the grid values (Easting value always first and equal number of digits from both the Easting and Northing values) to make the MGRS coordinate more defined:

18SUH1092 (SW corner of a 1,000 meter grid square containing our point of interest)

18SUH102920 (SW corner of a 100 meter grid square containing our point of interest)

18SUH10209208 (SW corner of a 10 meter grid square containing our point of interest)

If our grid coordinates were accurate down to the meter level, we could add a fifth digit to the grid Easting and grid Northing portion of the MGRS to indicate the SW corner of a 1 meter grid square.

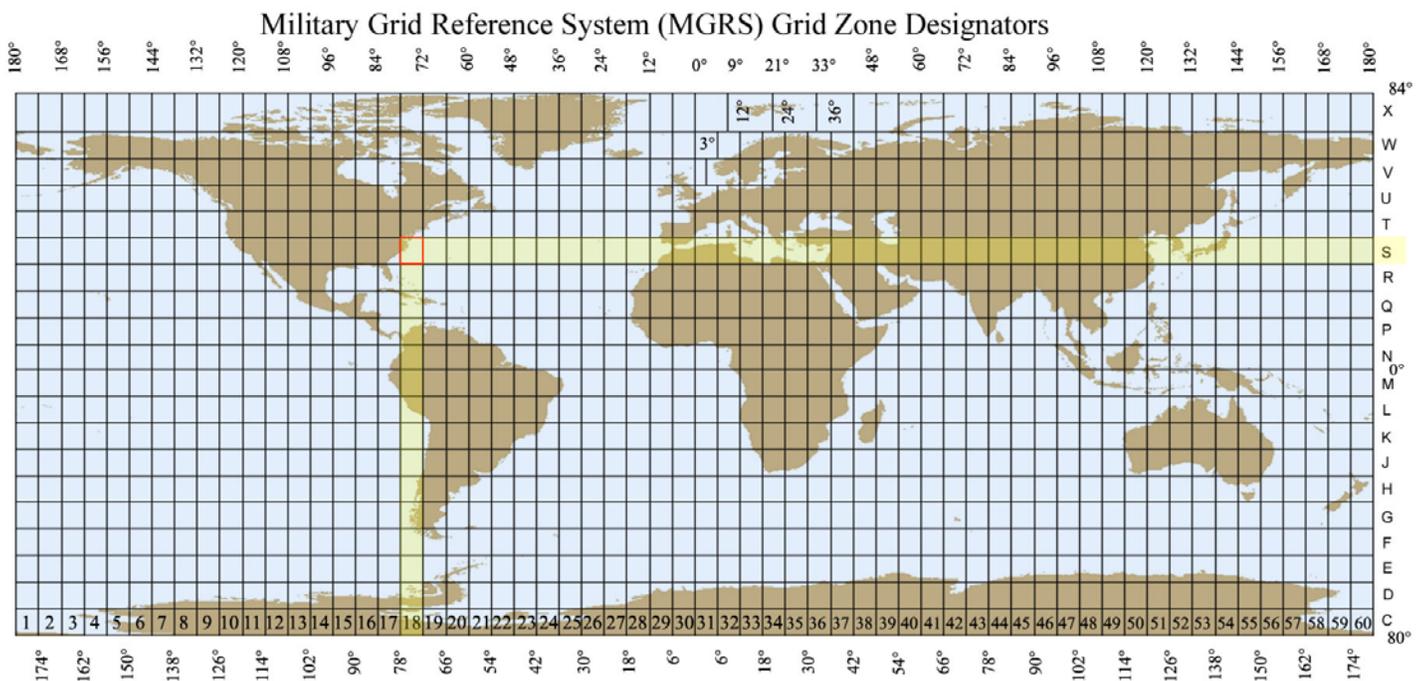
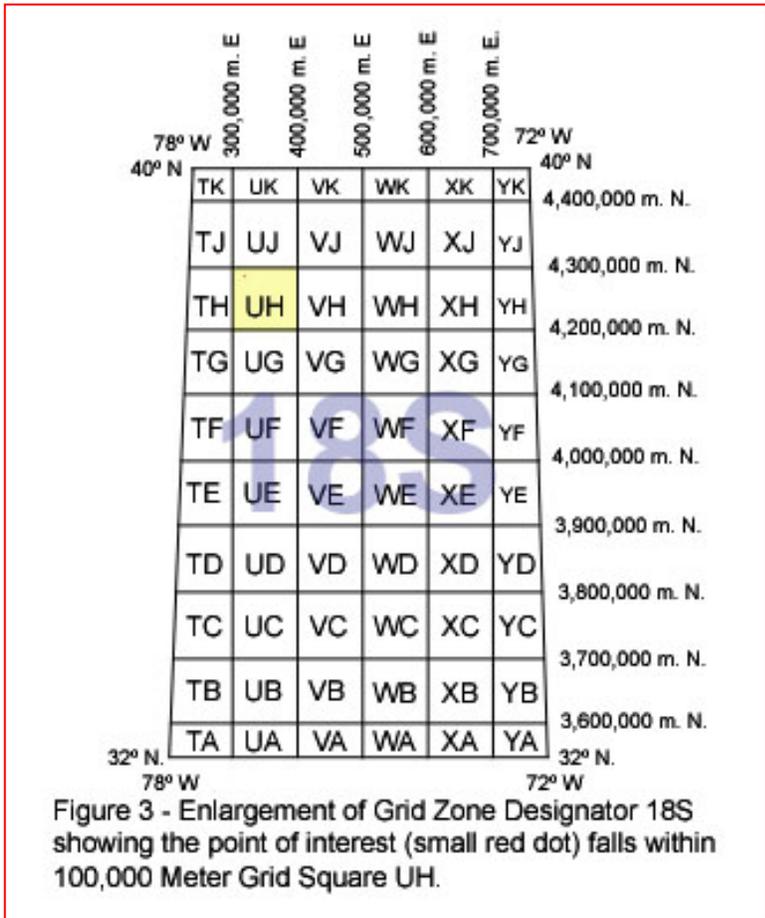


Figure 2 - The point of interest falls with the Grid Zone Designator 18S.



Next Article

The next article will focus on converting/transforming coordinates. It will discuss converting grid to geographic coordinates and reverse, transforming from a "local" datum to WGS 84 (World Geodetic System 1984), and converting MGRS coordinates to UTM (or UPS) grid values or geographic values.

NGANet Basic Geodesy Article Archive -

<http://www.geoint.nga.ic.gov/products/gandg/coordsys/geoarticles/geoarticles.html>

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