



COMPLIANCE COMPONENT

DEFINITION	
<i>Name</i>	United States National Grid Data Element Standard
<i>Description</i>	The United States National Grid (USNG) is a nonproprietary alphanumeric referencing system derived from the Military Grid Reference System (MGRS) that is being promoted to increase the interoperability of location services appliances with printed map products by providing a nationally consistent grid reference system.
<i>Rationale</i>	Location is playing a larger role in the development and integration of Missouri's assets and databases. In 2005, the Department of Homeland Security (DHS) recommended that any DHS grant submission reference the use of a nationally defined coordinate system for all spatial referencing, mapping, and reporting. DHS recognized that many different coordinate systems can be used to reference incident events in time and space. The expanding use of portable GPS-enabled devices, public safety access points (PSAP)-enhanced cell phones, and automated vehicle location (AVL) technology has increased the need for accurate and consistent identification, communication, and mapping of ground coordinates. A consistent system is important because people cannot easily convert between multiple reference systems without the aid of location services appliances, calculators, or conversion tables.
<i>Benefits</i>	The objective of this U.S. National Grid standard is to create a more interoperable environment for developing location-based services within the United States and to increase the interoperability of location services appliances with printed map products by establishing a nationally consistent grid reference system as the preferred grid for NSDI applications. The U.S. National Grid is based on universally-defined coordinate and grid systems and can, therefore, be easily extended for use world-wide as a universal grid reference system.
ASSOCIATED ARCHITECTURE LEVELS	
<i>Specify the Domain Name</i>	Information
<i>Specify the Discipline Name</i>	Data Management, Geospatial
<i>Specify the Technology Area Name</i>	Data Element Standards
<i>Specify the Product Component Name</i>	
COMPLIANCE COMPONENT TYPE	
<i>Document the Compliance Component Type</i>	Standard
<i>Component Sub-type</i>	
COMPLIANCE DETAIL	
<i>State the Guideline, Standard or Legislation</i>	USNG relies on the familiar Universal Transverse Mercator (UTM) coordinate system and is applied not only in the United States but also worldwide. USNG is a nonproprietary alphanumeric referencing system derived from the Military Grid Reference System (MGRS). Many GPS receivers, from recreational to survey-grade instruments, support and report positional information in an MGRS/USNG format. ArcGIS 9.1 includes grid and graticule support for map layouts. The ESRI Military Analyst extension supports MGRS with a dynamic coordinate conversion and provides batch conversion of data from decimal degrees to MGRS coordinates in addition to degrees, minutes, seconds (DMS) and UTM.

How to Read a United States National Grid (USNG) Spatial Address

The USNG is an alpha-numeric reference system that overlays the UTM coordinate system. A USNG spatial address is broken down into three parts, they are;

- * Grid Zone Designation; for a world-wide unique address.
- * 100,000-meter Square Identification; for regional areas.
- * Grid Coordinates; for local areas.

This format allows a spatial address to be truncated (or another term might be **abbreviated**). For example, stationary letterhead for the Department of Interior might portray the address as:

Department of Interior
1849 C Street NW, Washington, DC 20006
USNG: 18SUJ22850705 (NAD 83)

A complete USNG spatial address provides a unique value and is necessary for use with GPS receivers and Geographical Information Systems (GIS). The USNG spatial address from the above stationary letterhead is for the building's centroid. On the other hand, a Department of Interior employee might tell someone coming to visit from the local area, "Our south visitor's entrance is located on 1849 C Street NW, at grid 22850694." Another spatial address might identify the north visitor's entrance, and another set might identify the loading ramp for delivery vehicles.

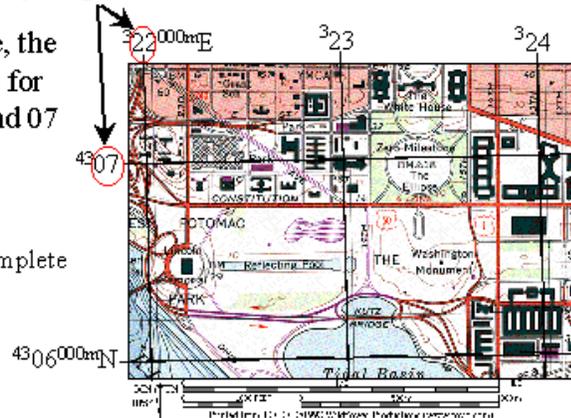
Local Area; reading grid coordinates. Grid coordinates are used to define a particular place within a local area (within a 100 by 100 kilometer area). Coordinates are written along the sides of a map designating specific grid lines. (These grid lines are based on UTM values.) The two larger numbers identify a grid line and are known as **principal digits** as depicted below.

Principal Digits...

...identify the grid line.

In this example, the principal digits for grid lines 22 and 07 are circled.

The superscript values are for complete UTM values.



To plot coordinate values, always **read right, then up**. Coordinates are always given as an even number of digits so you know where to separate the easting and northing coordinates. This allows you to abbreviate to the degree of precision you require within a local area. Grid coordinates are used to define point features,

such as a neighborhood, soccer field, a particular house, or even a parking place. These require different levels of granularity. For example;

4 digits - 2306 - point precision of 1,000-meters (a neighborhood size area).

6 digits - 234064 - point precision of 100-meters (a soccer field size area).

8 digits - 23480647 - point precision of 10-meters (the size of a modest home).

10 digits - 2348306479 - point precision of 1-meter (within a parking spot).

In the following example, the Washington Monument is described as being located at grid 23480647 (think 2348 / 0647). Read right to grid line 23 (using the principal digits). Then count grid lines up to line 06. This intersection is known as grid 2306. This four digit value would give the location to within 1,000-meters. Measuring right in meters from line 23, we find the Washington Monument is another 480 meters east. The complete easting component is 23480. Measuring up in meters from grid line 06 the Monument is another 470-meters north. The complete northing component is 06470. We drop the 1-meter level values (shown as 0s in this case), and combining the easting and northing components, the grid coordinate is given as an eight digit value (to within 10-meters) as:

Grid: 23480647

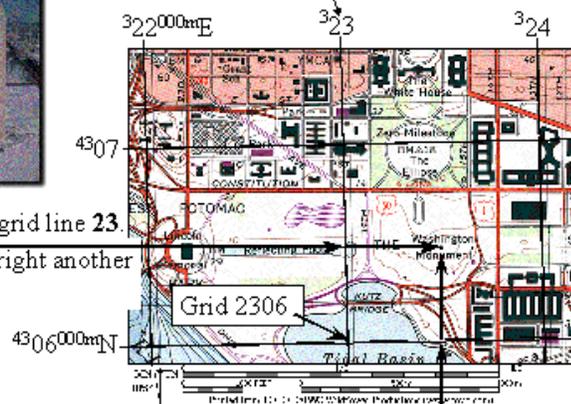
Reading Grid Coordinates... "Read RIGHT, Then UP."

The Washington Monument is located at grid **23480647**
(think **2348 / 0647**)



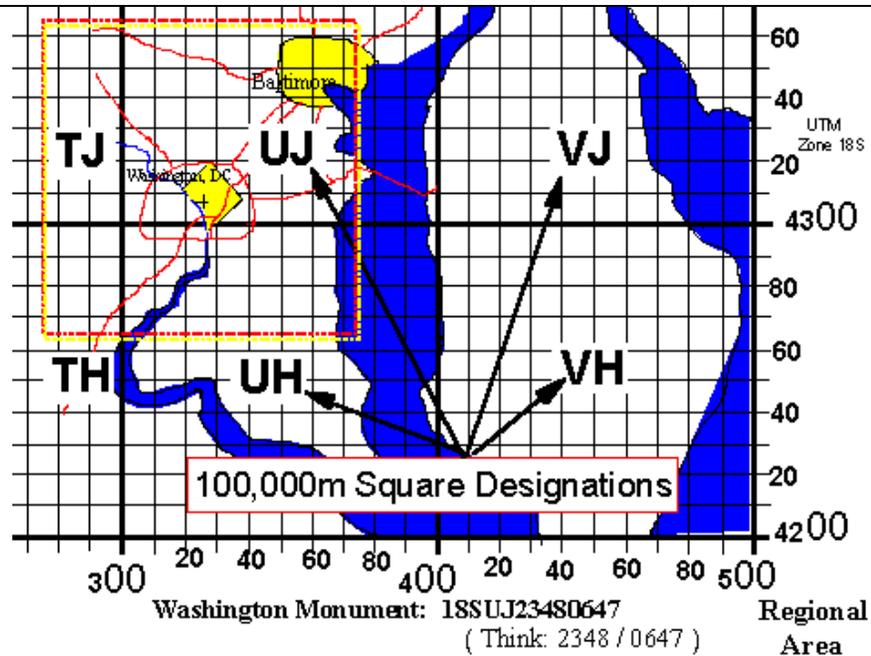
Read **RIGHT** to grid line **23**.

Then measure right another
480 meters



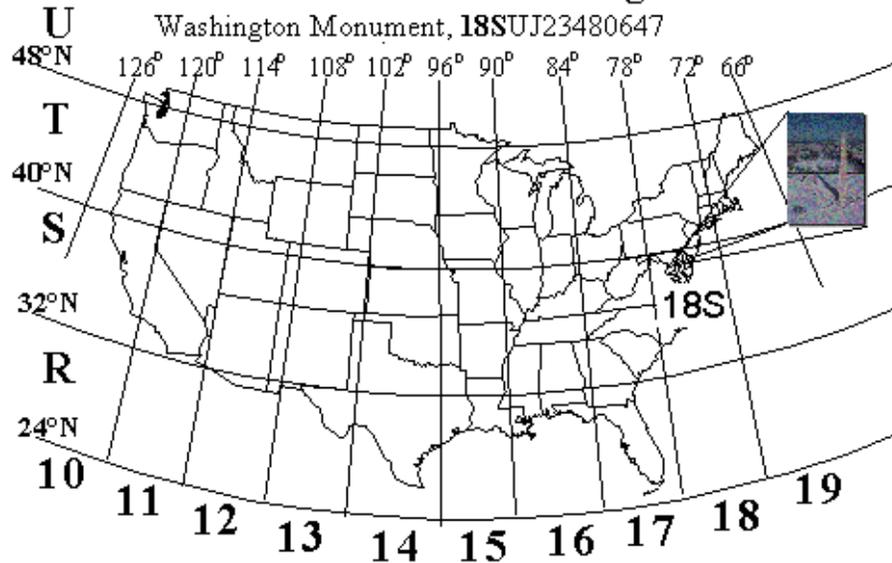
Then, read **UP** to grid line **06**, and measure up another 470 meters.

Regional Area; 100,000-meter Square Identification. The USNG further divides the world into 100,000-meter squares and identifies these with two letter values. While the USNG is referred to as an alpha-numeric reference system for the UTM coordinate system, it is actually much more. The lettering scheme for the 100,000-meter Square Identification is designed such that any two-letter combination will not repeat itself but every 18° of longitude and a similar area in latitude. Thus any two letter prefix to a grid coordinate will provide a unique value within a very large area.



World-Wide Unique Values; Grid Zone Designations. Working out from a local area, through regional areas, the last level of definition in a spatial address is the Grid Zone Designation. The world is divided into 60 UTM Zones, each 6° degrees of longitude wide. The numbering scheme for these begins at 180° longitude, and counts east. The conterminous US is covered by Zones 10 through 19. In a northing direction, the world is divided into 8° belts of latitude. The conterminous US for example is covered by belts R, S, T, and U. Thus the Washington DC area falls within Grid Zone Designation 18S as depicted below. This prefix identifies a unique US National Grid spatial address for the Washington Monument over the entire planet. This complete and unique spatial address is required for GPS receivers.

UTM/MGRS Grid Zone Designations



To review, we can see a complete US National Grid spatial address contains three parts as we drill down to a unique location,

1. Grid Zone Designation (i.e. 18S).
2. 100,000-meter Square Identification (i.e. UJ).
3. Grid coordinates of some even number of digits ranging from 2 to 10 (i.e. 23480647 In this case, eight digits identify a place of about the size of a modest home.). You always read right, then up when plotting coordinates.

A spatial address is customarily written as a single string of values. Note how the horizontal datum (NAD 83) has been included:

USNG: 18SUJ23480647 (NAD 83)

Datum

The State of Missouri is using **North American Datum 1983 (NAD83)** as its **geodetic reference system**. All USNG values to be used for data transfer and storage in Missouri systems should be expressed in **NAD83**. In cases where the coordinates are expressed in NAD27 (or other datum), the coordinates should be converted to NAD83 using GIS tools.

Storage of National Grid Coordinates

<u>Data Element</u>	<u>Data Type</u>	<u>Width</u>	<u>Description</u>
USNG-GZD	Character	3	National Grid coordinate field Grid Zone designation
USNG-RA	Character	2	National Grid coordinate field Regional Area designation
USNG-Coord	Character	10	National Grid coordinate field designation to precision of 1 meter. Depending on business requirements this field can be expanded to 16 to support precision of 1mm
Datum	Character	5	Datum for coordinate reference

Document Source Reference #

Standard for a U.S. National Grid: FGDC-STD-011-2001
www.fgdc.gov/standards/projects/FGDC-standards-projects/usng/fgdc_std_011_2001_usng.pdf

Maintenance authority: [Public XY Project](#)

Compliance Sources

<i>Name</i>	FGDC – Federal Geographic Data Council	<i>Website</i>	www.fgdc.gov
<i>Contact Information</i>	www.fgdc.gov/usng/index.html		
<i>Name</i>	Public XY Project	<i>Website</i>	http://www.xyproject.org/
<i>Contact Information</i>			

KEYWORDS		
<i>List Keywords</i>	Location, United States National Grid, USNG, Datum, Position, homeland security	
COMPONENT CLASSIFICATION		
<i>Provide the Classification</i>	<input type="checkbox"/> <i>Emerging</i> <input checked="" type="checkbox"/> <i>Current</i> <input type="checkbox"/> <i>Twilight</i> <input type="checkbox"/> <i>Sunset</i>	
<i>Sunset Date</i>		
COMPONENT SUB-CLASSIFICATION		
Sub-Classification	Date	Additional Sub-Classification Information
<input type="checkbox"/> <i>Technology Watch</i>		
<input type="checkbox"/> <i>Variance</i>		
<input type="checkbox"/> <i>Conditional Use</i>		
Rationale for Component Classification		
<i>Document the Rationale for Component Classification</i>	<p>The National Grid component provides another manner in which the location data element is captured and stored with the database. This allows for fluent and accurate interchange of location information between state agencies in support of homeland security and emergency management events that by their necessity requires federal resources (Department of Defense, FEMA, etc.) to interoperate with response efforts.</p>	
Migration Strategy		
<i>Document the Migration Strategy</i>	<p>Missouri State Interagency Strategy Agencies shall adhere to this standard when sharing common data elements</p> <p>Inter-governmental Migration Strategy Agencies creating new applications should attempt to adhere to the data elements standards when defining the data definitions</p>	
Impact Position Statement		
<i>Document the Position Statement on Impact</i>		
CURRENT STATUS		
<i>Provide the Current Status</i>	<input type="checkbox"/> <i>In Development</i> <input type="checkbox"/> <i>Under Review</i> <input checked="" type="checkbox"/> <i>Approved</i> <input type="checkbox"/> <i>Rejected</i>	
AUDIT TRAIL		
<i>Creation Date</i>	4/5/06	<i>Date Approved / Rejected</i> 06/13/06
<i>Reason for Rejection</i>		
<i>Last Date Reviewed</i>		<i>Last Date Updated</i>
<i>Reason for Update</i>		