

Executive Summary

U.S. National Grid Supporting Public Safety, Commerce, and the General Public

Background. The Federal Geographic Data Committee's U.S. National Grid (USNG) standard provides a nationally consistent *language of location* that has been optimized for local applications.

- All street maps use a standard set of street names and addresses to locate places. The USNG does not replace this practice; it complements it. The USNG expands the utility of topographic, street, and other large-scale maps by adding several powerful features: It provides a grid reference system that is seamless across jurisdictional boundaries; it provides the foundation for a universal map index; it enables user-friendly position referencing on appropriately gridded paper and digital maps, with Global Positioning System (GPS) receivers; and World Wide Web map portals.
- USNG may be the only unambiguous way to describe locations when the end-user is operating either in an area away from the established road network, or in an area impacted by a natural disaster where road signs have been destroyed.
- Private citizens, public agencies, and commercial enterprises can use USNG. It has obvious applications in navigation, command and control (C2), and public safety response (e.g., police, fire, rescue, National Guard). The simple linear increments of USNG has shown itself to require less training time to master and produces fewer operator errors than the more complex angular increments of latitude and longitude – such that the USNG be effectively taught at the 5th grade level.
- USNG is a Presentation Standard. It does not replace data storage formats for either Geographic Information Systems (GIS) or the State Plane Coordinate System (SPCS) for engineering and survey applications.
- USNG is an alphanumeric point reference system that has been overlaid on the Universal Transverse Mercator (UTM) numerical grid. Every modest size home in a discrete area (city) can be described using 8-digits (e.g., 1234 5678). By adding a two-letter prefix (e.g., XX 1234 5678) the location is uniquely identified regionally (state-wide). This alphanumeric designator can be used today with consumer GPS receivers costing less than \$100.
- The USNG improves interoperability, military support to civil authorities, and reduces operational friction – facilitating crisis and disaster response at all levels – from federal to local government. The Army National Guard is trained to use the USNG format as the USNG and the Military Grid Reference (MGRS) values are identical when referenced to WGS 84 or NAD 83 datum.
- Additional information: www.fgdc.gov/usng

The US National Grid (USNG): A Simple and Powerful Geospatial Tool

Information Sheet 4 in this series.

FGDC-STD-011-2001

From www.fgdc.gov/usng

The Problem. In a time of growing location based services (i.e. Global Positioning System, etc.), need to support homeland security/emergency services, the general public, and commercial activities with better geospatial information capabilities, we had no standard, nationally consistent map grid. *For example:* Washington, DC maps for consumers. - 35 maps, 30 different atlas grids. - Same street names, but different grids, none of which work with GPS. - No universal map index.



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The Solution. US National Grid (USNG).

This standard established a nationally consistent grid reference system, just as all street maps use a common set of street names. USNG provides a seamless plane coordinate system across jurisdictional boundaries and map scales; it enables precise position referencing with GPS, web map portals, and hardcopy maps. Unlike latitude and longitude, the USNG is *simple* enough that it can be taught and effectively used at the 5th grade level. It enables a practical system of *geoadresses* and the *universal map index*.

Point of Interest	Street Address	USNG Grid:	Telephone:
		18S UJ	(202)
Subway Sandwich & Salads	2030 M St., NW	2256 0826	223-2587
Subway Sandwich & Salads	1412 Good Hope Rd., SE	2781 0387	889-5888
Subway Sandwich & Salads	3504 12 th St., NE	274 112	526-5999
Subway Sandwich & Salads	1500 Benning Rd, NE	2815 0757	388-0421

Three purposes of the USNG on larger-scale maps:

- Provide a N-S baseline for measuring direction.
- Provide visual scale and to measure distance.
- Provide a standard XY convention to describe locations.

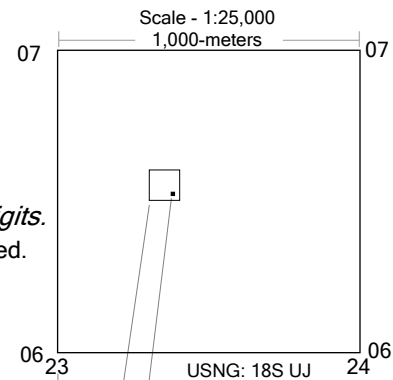
→ **Organization and abbreviation of a USNG grid value.**

- Complete USNG value: 18S UJ 2337 0651 - World wide unique.
- Without Grid Zone Designation (GZD): UJ 2337 0651 - Regional areas.
- Without GZD and 100,000-m Square ID: 2337 0651 - Local areas.

A flexible reference system: Use the precision you require, truncate insignificant digits.
2 to 10-digits -- each additional digit pair improves precision by an order of magnitude squared.

How we graph locations with the grid: Read *right*, then *up*.

Locating the Jefferson Pier at: 18S UJ 23371 06519



Four digits: 23 06 Locating a point within a 1,000-m square.
Requires two more characters than the classic atlas grid (i.e. A3), yet seamlessly ties into a standards based, globally extent, locally optimized grid reference system.

Six digits: 233 065 Locating a point within a 100-m square (football field size).
Think, "23.3 06.5" Another digit pair guides the eye to 1% of the 1,000-m grid square.

Eight digits: 2337 0651 Locating a point within a 10-m square (modest size home).
Adding another digit pair allows easy measurable, discrimination of 1 / 10,000 of the grid square.
This is too precise for visual estimation, but is easily and accurately measured with a Romer Scale.

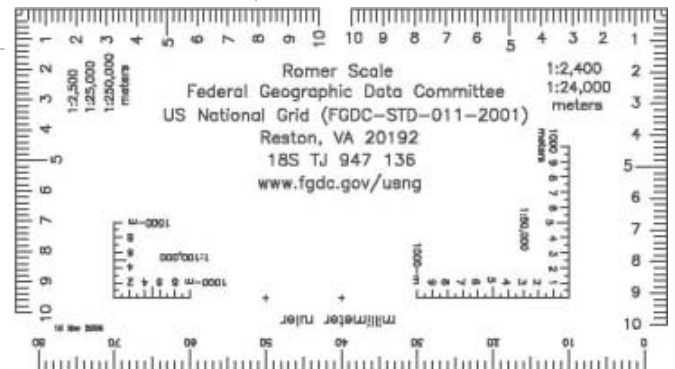
Ten digits: 23371 06519 Locating a point within a 1-m square (manhole cover size).
Another pair of digits allows discrimination of 1 / 1,000,000 of the grid square.
This is far too precise for measurement on a map of this scale.
It is useful on maps larger than ~ 1:5,000 using a Romer Scale.

- The USNG enables a nationally consistent language of location, optimized for local applications.
6 and 8-digit grids: The most commonly used formats in a local setting.



Consumer GPS receivers (<\$100) can locate a USNG point position to within 4-meters half of the time, and to within 8-meters 95% of the time.

Examples of use include in New Orleans, LA during Hurricane KATRINA response, and adoption by Skagit County, WA, Clark County, CO, the State of Florida, FEMA Urban Search and Rescue (US&R), USGS, Census Bureau, DoD, Garmin, Magellan GPS, ESRI, Delorme, and others.



Reading US National Grid (USNG) Coordinates: "Read right, then up."

Information Sheet 1 in this series.

FGDC-STD-011-2001

From www.fgdc.gov/usng

The example below locates the Jefferson Pier at USNG: 18S UJ 23371 06519.

U.S. National Grid	
100,000-m Square ID	
UJ	⁴³ 00
UH	
Grid Zone Designation	18S

A USNG value has three components.

Some maps may give this leading information in a grid reference box.

Grid Zone Designation (GZD):

6° x 8° longitude zone / latitude band.

100,000-m Square Identification:

18S UJ 2337 0651

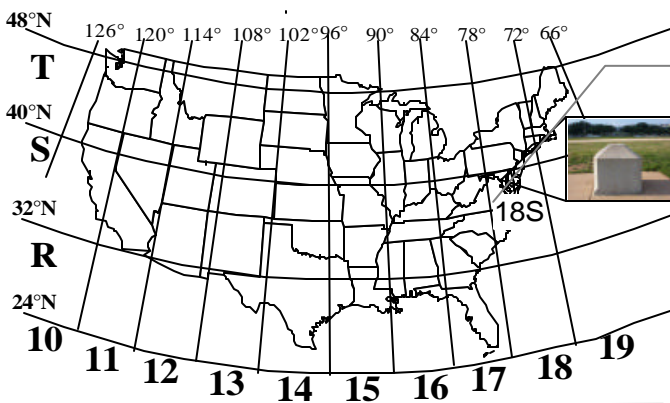
Grid Coordinates:

Read right, then up.

"Read right, then up."

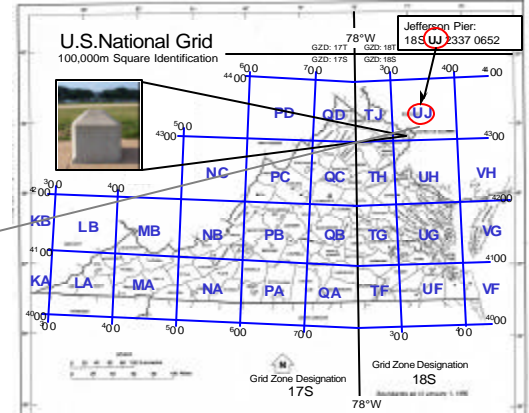
USNG values have three components as seen above. The GZD gives a USNG value world-wide context with 60 longitudinal zones each 6° wide. Zones 10 - 19 cover the conterminous U.S. as seen below left. UTM zones are divided into 8° latitudinal bands. Together these make up 6° x 8° Grid Zone Designations (GZD). Example: 18S

U UTM/USNG Grid Zone Designations



Example:

18S UJ



GZDs are further subdivided into large squares with 100,000-m Square Identifications. In this example, the Jefferson Pier is located in UJ. These squares are organized and lettered so they do not repeat themselves but every 18°, which is approximately 1,000 miles in the mid-latitudes. The illustration at above right depicts the organization of 100,000-m Square ID's over a particular state -- Virginia in this case. In the conterminous U.S. a given value such as UJ 2337 0651 is unique out of the entire state it is located in, as well as all surrounding states.

- Grid lines are identified by **Principal Digits**. Ignore the small superscript numbers like those in the lower left corner of this map.

Reading USNG Grid Coordinates.

- Coordinates are always given as an even number of digits (i.e. 23370651).

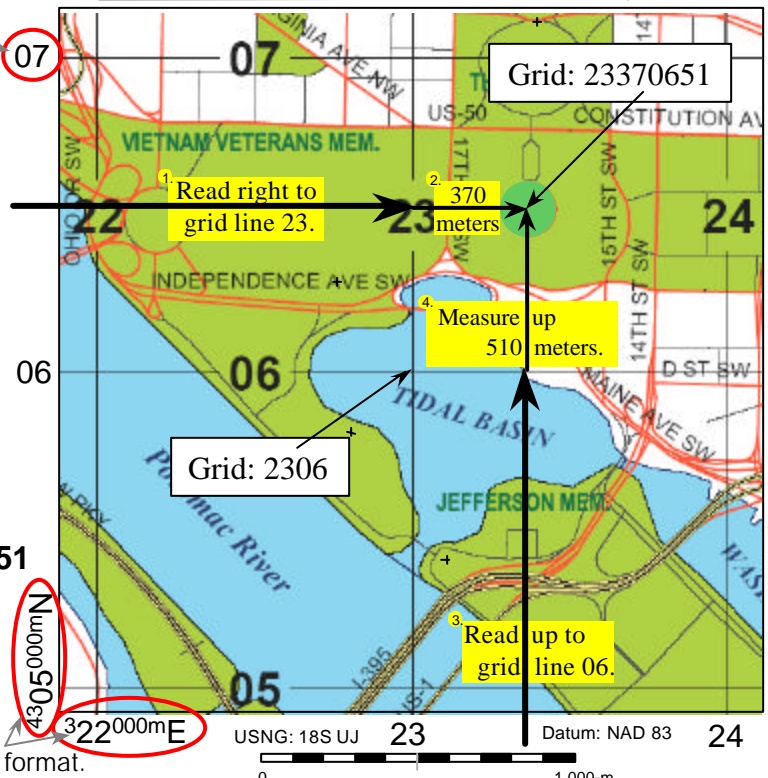
- Separate coordinates in half (2337 0651) into the easting and northing components.

1. Read right to grid line 23. 2. Then measure right another 370 meters. (Think 23.37)

3. Read up to grid line 06. 4. Then measure up another 510 meters. (Think 06.51)

A complete reference is: 18S UJ 2337 0651

Grid:	Point of Interest:	
228 058	FDR Memorial:	+
231 054	George Mason Memorial:	+
2338 0710	Zero Milestone:	+
2275 0628	DC War Memorial:	+
222 065	Lincoln Memorial:	



UTM format.

USNG: 18S UJ 23 06 Datum: NAD 83 24

Ignore the small UTM superscript numbers that are provided for reference purposes. UTM numerical values are best suited for determining direction and distance as in surveying. USNG alpha-numeric values are best suited for position referencing because they can be given as only grid coordinates in a local area and with only the precision required for a particular task.

US National Grid (USNG) Implementation Discussion Points

Requirement. Insitute a policy that adopts the U.S. National Grid standard as an officially recognized way to describe locations. Immediate implications from the policy decision:

1. Integrate USNG into E9-1-1, Emergency Operations Centers, GIS technologies, and downstream public safety operations.
2. Encourage use by local government and public utilities.
3. Initiate outreach to GIS and commercial mapping communities.
4. Educate business community regarding the efficiencies to be gained with respect to commerce.

Four Pillars of USNG Implementation

1. **Education.** An education policy must be both developed and implemented which explains the benefits of the system and the *how to* for using it.
 - Get out the word through all forms of media. Public affairs and media for general public education. Enlist GPS vendors.
 - Web based training (e.g., target first responders and general public)
 - Integrate USNG into school curricula (e.g., Geoscience courses - ensure numerous practical applications are included in the curriculum).
 - University centers for information and to support users.
2. **USNG Gridded Maps.** Prepare appropriately “gridded” hardcopy and digital maps for end-users.
 - Implement on state/local government GIS web sites (e.g., The National Map, DC GIS, PALANTERRA).
 - Link downloadable gridded GeoPDF maps from various web sites (e.g., state, local, Miss Utility) to provide information such as Emergency Shelter Maps, State Visitor Highway Maps.
 - Display with library and other institutional wall maps.
 - Encourage commercial hardcopy map and map/imagery web site adoption. (Competition).
 - Place appropriately gridded street atlases in public safety and utility company vehicles either as the primary street map or as the back up to the digital display system.
3. **Geo-Address availability for both addresses and Points of Interest (POI)**
 - Integrate into map, atlas, and stand-alone indexes.
 - Use on business cards, letterhead, phone directories, and other address opportunities.
 - Adopt web applications for address databases similar to Washington, DC GIS.
<dcgis.dc.gov/mar_client_sample/>
4. **Location Identification Services.** Investigate utility of instituting the provisions of the Threshold Automobile GPS Initiative (TAGI).